1267

1988 AIR QUALITY DATA SUMMARY

REGIONAL MUNICIPALITY OF NIAGARA

SEPTEMBER 1990

Ontario
Environment
Environnement

91-00929/

ISSN 0836-0545

1988 AIR QUALITY DATA SUMMARY

REGIONAL MUNICIPALITY OF NIAGARA

Report prepared by:
F. Dobroff
Air Quality Assessment
West Central Region

SEPTEMBER 1990

Copyright: Queen's Printer for Ontario, 1990
This publication may be reproduced for non-commercial purposes with appropriate attribution

PIBS 1263
log 89-4400-007

TABLE OF CONTENTS

	Page
INTRODUCTION	1
MONITORING NETWORK	2
POLLUTANTS MONITORED	4
DATA ANALYSIS	
Niagara Falls	11
Chippawa	28
Port Colborne	38
St. Catharines	38
Thorold	57
Welland	69
SUMMARY	75

LIST OF FIGURES

		Page
Figure 1	Wind Frequency Distribution - 1988	3
2	Location of Niagara Falls AQI Station	13
3	Sulphur Dioxide Yearly Trend - Niagara Falls API Station	14
4	Soiling Index Yearly Trend - Niagara Falls AQI Station	15
5	Sulphur Dioxide Pollution Rose - Niagara Falls AQI Station	16
6	Soiling Index Pollution Rose - Niagara Falls AQI Station	17
7	Ozone Pollution Rose Niagara Falls AQI Station	18
8	Suspended Particulate Yearly Trend - Niagara Falls AQI Station	20
9	Location of Niagara Falls Industry Stations	21
10	Total Reduced Sulphur Yearly Trend - General Abrasives	22
11	Sulphur Dioxide Pollution Rose - General Abrasives	24
12	Total Reduced Sulphur Pollution Rose - General Abrasives	25

LIST OF FIGURES (Cont'd.)

		Page
13	Soiling Index Pollution Rose - General Abrasives	27
14	Location of Chippawa Stations	30
15	Sulphur Dioxide Exceedence Trends - Nortons	31
16	Total Reduced Sulphur Exceedence Trends - Nortons	32
17	Sulphur Dioxide Pollution Rose - Nortons	34
18	Total Reduced Sulphur Pollution Rose - Nortons	35
19	Suspended Particulates Yearly Trend - Nortons	36
20	Dustfall Yearly Trend - Nortons	37
21	Location of Port Colborne Station	40
22	Location of St. Catharines Stations	43
23	Sulphur Dioxide Yearly Trend - St. Catharines AQI Station	44
24	Soiling Index Yearly Trend - St. Catharines AQI Station	45
25	Carbon Monoxide Yearly Trend St. Catharines AQI Station	46

LIST OF FIGURES (Cont'd)

		Page
26	Nitrogen Dioxide yearly Trend St. Catharines AQI Station	47
27	Ozone Exceedence Trend St. Catharines AQI Station	48
28	Sulphur Dioxide Pollution Rose - St. Catharines AQI Station	49
29	Soiling Index Pollution Rose - St. Catharines AQI Station	50
30	Carbon Monoxide Yearly Trend - St. Catharines AQI Station	51
31	Nitrogen Dioxide Yearly Trend - St. Catharines AQI Station	52
32	Ozone Yearly Trend - St. Catharines AQI Station	53
33	Suspended Particulates Yearly Trend - St. Catharines AQI Station	54
34	Dustfall Yearly Trend - St. Catharines Industries	55
35	Location of Thorold Stations	59
36	Sulphur Dioxide Yearly Trend - Thorold Industries	60
37	Dustfall Yearly Trend - Quebec and Ontario Paper	61

LIST OF FIGURES (Cont'd)

		Page
38	Total Reduced Sulphur Yeai y Trend - Exolon	64
39	Sulphur Dioxide Pollution Rose - Exolon	65
40	Total Reduced Sulphur Pollution Rose - Exolon	66
41	Soiling Index Pollution Rose - Exolon	67
42	Location of Welland Stations	71
43	Suspended Particulates Yearly Trend - Union Carbide	72
44	Dustfall Yearly Trend - Union Carbide	73

LIST OF TABLES

	Data Summaries - 1988	Page
Table 1	Air Quality Index - West Central Region	10
2	Niagara Falls	12
3	Chippawa	29
4	Port Colborne	39
5	St. Catharines	42
6	Thorold - Quebec and Ontario Paper Ltd.	58
7	Thorold - Exolon Ltd.	63
8	Thorold - Domtar Construction Materials Ltd.	68
9	Welland	70

ABSTRACT

This report summarizes the results of air monitoring in the Regional Municipality of Niagara in 1988.

General ambient air quality as characterized by Niagara Falls and St. Catharines Air Pollution Index stations was excellent, with the exception of summer ozone episodes. Monitoring near industrial sources showed local air quality problems existed. These include:

- General Abrasives in Niagara Falls where particulate fallout and occasional odours occurred. The company modified their control systems and have effectively controlled stack emissions through incineration of furnace gases. However, it has now been discovered that fugitive emissions through holes in the geodesic domes were also a significant source. The holes were caused by the corrosive furnace gases. The company has committed to an improved maintenance program for these domes as well as implementing operational changes to limit fugitive emissions.

- Cyanamid in Niagara Falls where particulate fallout occurred. The company installed new baghouses to collect materials handling emissions in 1987 and installed additional collection systems for furnace unloading operations in 1988.

- Norton Company in Chippawa where particulate fallout and occasional odours occurred. Emission sources were mainly fugitive (i.e. non-stack) in nature. The odour source is currently under study to determine best method for control while dust emissions will be reduced through improved collection of materials handling emissions and better housekeeping.

- Ontario Paper Limited in Thorold where particulate fallout occurred, due likely to truck traffic and demolition of the chemical recovery plant, the main source of emissions in the past.

- Exolon Limited in Thorold where particulate fallout and odours occurred. The company instituted, but did not complete, a voluntary control program to modernize furnace operations. The Ministry will conduct an emission survey of the plant in 1989 with the intent of serving a Control Order.

- Aimco Foundry in St. Catharines where particulate fallout occurred probably due to poor maintenance of dust control systems and poor housekeeping. Another plant emission survey is scheduled for 1989 and the company will submit a voluntary control program, also in 1989.

- Burnstein Castings in St. Catharines where particulate fallout and odours occurred. A Control Order was served in 1988 to address emission problems, however, the company appealed.

- General Motors Foundry in St. Catharines, where particulate fallout occurred. General Motors replaced one furnace control system in September, 1988 and the other furnace control system will be replaced in 1989.

- Union Carbide in Welland where particulate fallout occurred. The company will be required to develop a control program to control dust emissions from a furnace operation by 1989. The Ministry's Investigations and Enforcement Branch have laid charges against the company in response to specific fallout incidents in 1987 and 1988.

INTRODUCTION

This report summarizes the results of air monitoring in the Regional Municipality of Niagara in 1988.

The Ministry of the Environment has conducted routine monitoring in the area since the early 1970's. The Air Management Program in Ontario is based on controlling man-made emissions to meet ambient air quality objectives, which in turn are based on known effects on health, quality of life or sensitive vegetation, whichever is most stringent. To achieve these objectives, sources of pollution are identified, their emissions evaluated and appropriate control measures are instituted. Ambient air monitoring is used to identify pollution sources, evaluate the need for controls and then determine whether controls have been successful.

In addition to monitoring specific industrial sources, monitoring of a more general nature is also carried out in various localities to determine if air quality objectives are being met and to observe trends in air pollution.

In June, 1988, the Ministry commenced broadcasting the new Air Quality Index across the Province at over 30 locations, including St. Catharines and Niagara Falls. A description of the AQI and the 1988 results will appear later in this report.

MONITORING NETWORK

The Ministry of the Environment operates a network of monitors in the Regional Municipality of Niagara in Niagara Falls, Chippawa, Port Colborne, St. Catharines, Thorold, and Welland. The Air Quality Index (AQI) was measured in St. Catharines and Niagara Falls and was used as a warning system to alert the public to elevated air pollution levels.

Meteorological data (wind and temperature) were measured near Allanburg. Figure 1 illustrates the wind frequency distribution for the area and shows that winds from the west and southwest quadrants predominate. Consequently, wherever possible, fixed stations are normally located "downwind" of suspected pollution sources with respect to these wind directions.

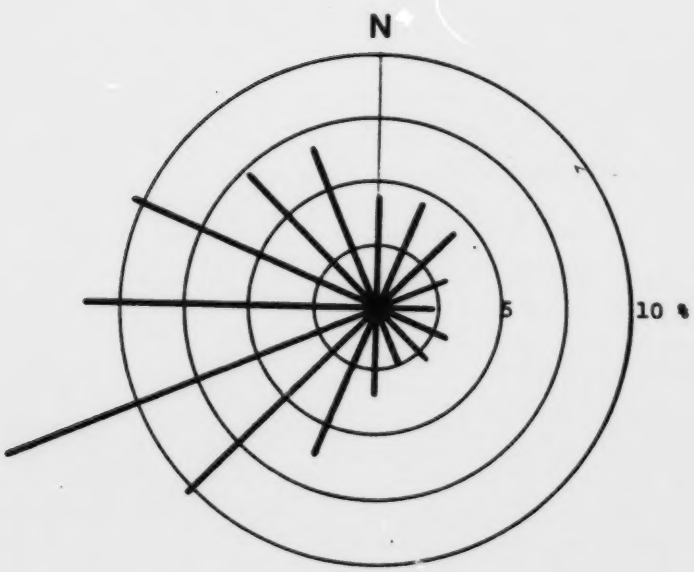
Wind data were utilized in a computer program known as a "pollution rose" - essentially a cross-tabulation of average hourly pollutant concentrations with wind direction. The data from this program are illustrated on various maps in this report and are a useful tool in determining the impact of any given source on a monitoring station. The length of each line of the "rose" is proportional to the average yearly concentration when the wind was blowing from that direction.

FIGURE 1

WIND FREQUENCY DISTRIBUTION

27011 - ALLANBURG

1988



Lines indicate direction wind blew from

POLLUTANTS MONITORED

Two basic types of air pollutants are measured-gases and particulates (dust).

a) Gases measured with continuous analyzers include:

-Sulphur Dioxide (SO_2) - usually monitored near industrial sources but SO_2 is also a product of domestic space heating. Air quality objectives and their limiting factors are:

1-hour average - .25 ppm (vegetation effects)
24-hour average - .10 ppm (health effects in conjunction with particulates)
1-year average - .02 ppm (vegetation effects)

-Total Reduced Sulphur (TRS) - measured exclusively near industrial sources. There is a one-hour TRS objective of 27 ppb, however, it is specifically for areas near Kraft pulp mills. The TRS measurement includes hydrogen sulphide (H_2S), the "rotten egg" gas as well as other sulphur compounds. A one-hour objective of 20 ppb exists for H_2S (given below). However, H_2S can actually be smelled at 10 ppb or less.

1-hour average - 20 ppb (odour)

-Carbon-Monoxide-(CO) - measured for general ambient levels in St. Catharines. The major source of CO is the automobile. Objectives for CO are:

1-hour average - 30 ppm (health effects)
8-hour average - 13 ppm (health effects)

-Ozone (O_3) - measured in St. Catharines and Niagara Falls to check general ambient levels. Oxidants are products of photochemical reactions involving oxides of nitrogen, hydrocarbons and sunlight. Ozone accounts for most of the oxidants produced. The sources of the precursor pollutants are mainly industrial and automotive. Concentrations follow very definite annual and daily trends with highest levels occurring during the summer, and daily maxima occurring in mid-afternoon. Both patterns are directly related to temperature and the amount and intensity of sunlight. Ozone and its precursors can be transported over great distances and can be augmented by local sources. Most of the high levels measured in Southern Ontario each summer arrive from the United States. An objective for ozone is:

1-hour average - 80 ppb (vegetation effects)

-Oxides of Nitrogen - general ambient levels were measured in St. Catharines. They are a products of high temperature combustion sources including the automobile. The most abundant oxides are nitric oxide (NO and nitrogen dioxide (NO_2). Objectives exist only for NO_2:

1-hour average - .20ppm. (odour)
24-hour average - .10 ppm (health effects)

b) Particulates (dust)are measured by three methods, each relating to a different size range of particles.

-Dustfall - heavy material generally greater than 10 microns in size (one micron is one-millionth of a metre) that settles out of the atmosphere by gravity. A plastic container is exposed for one month and the collected dust is weighed and expressed as a

deposition rate of grams/square metre/30 days. The measurement is imprecise and observations are restricted to relatively local areas. Criteria are:

1-month average - 7.0 g/m²/30 days (nuisance effects)

1-year average - 4.5 g/m²/30 days (nuisance effects)

-Total Suspended Particulates (TSP) - measured with high volume (hi-vol) samplers near industrial sources and for general ambient observations. The particles range from submicron to about 50 microns in size. The hi-vol sampler draws air through a glass fibre filter for a 24- hour period. The exposed filter is weighed and the weight of solids collected is converted to an equivalent concentration in air expressed in micrograms per cubic metre. The samplers run once every six days. Criteria based on health effects in conjunction with sulphur dioxide are:

24-hour average - 120 ug/m³ (health effects)
1 year geometric mean - 60 ug/m³ (health effects)

-Soiling Index (Coefficient of Haze) - measured by tape samplers which measure fine particles less than 10 microns. Industrial sources as well as general ambient air are monitored. Coefficient of haze tape samplers determine hourly soiling values. Air is drawn through a filter paper tape for one hour. A beam of light is shone through the paper before and after the airborne particles are collected. The difference in light transmission is translated into a coefficient of haze (COH) unit. The paper tape then advances and a new hourly sample is collected. The criteria shown below are based largely on correlations with total suspended particulate (TSP).

24-hour average - 1.0 COH's/1000 linear feet of air
1-year average - .5 COH's/1000 linear feet of air

c) Air Pollution Index (API) - The API is a subindex of the new AQI. It is derived from 24-hour average concentrations of sulphur dioxide and soiling index, based on the following equations:

St. Catharines

$API=3.02\ (2.20\ COH + 193.6\ SO_2).^{74}$

Niagara Falls

$API = 2.54\ (11.7\ COH + 123.5\ SO_2).^{80}$

where:
COH is the 24-hour average soiling index concentration expressed in coefficient of haze units.

SO_2 is the 24-hour average concentration of sulphur dioxide expressed in parts per million.

Values below 32 are considered acceptable. At 32, known as the advisory level and with a forecast of continued unfavorable weather conditions, significant industrial sources may be asked to voluntarily curtail operations. At an API of 50, major emitters would be ordered by law to curtail some operations. At 75, further cutbacks would be required and at 100, all sources not essential to the public health and safety could be ordered to cease operations.

Air Quality Index (AQI) - The AQI is a system by which the public can be informed about air quality on a daily and even hourly basis. The index replaced the API

(described above) which had been in place since 1970, although as mentioned, the API still exists as a subindex of the AQI.

In the AQI, hourly concentrations of sulphur dioxide, soiling index (particles), nitrogen dioxide, carbon monoxide, ozone and reduced sulphur compounds are all converted to a common scale of numbers. In addition to these hourly measurements, 8-hour average levels of carbon monoxide and the API, a 24-hour function of sulphur dioxide and particles are also included as subindices, making a total of 8 potential subindices measured every hour. The official AQI broadcast is the highest subindex at that time.

The AQI scale is classified as follows:

0-15 Very Good
16-31 Good
32-49 Moderate
50-99 Poor
100 - Very Poor

Index levels up to 31 should have little or no effect on people and the environment. Beginning at the moderate level, effects such as odour, vegetation damage and some health effects to sensitive individuals start to occur.

In the poor and very poor categories, these symptoms become more and more acute, such that virtually all people would be hampered in the very poor range.

When moderate levels or higher are measured, public health advisories can be issued to the public along with the actual index number.

The AQI started in June, 1988, and statistics on hourly frequencies in the five concentration categories for nine West Central Region stations are presented in Table 1.

Although the index only began in June, the AQI results are presented as if the index had been in actual operation for the entire year. As can be seen, ozone (O_3) was the most problematic pollutant across the Region. More details on this pollutant and others in the AQI will be discussed in more detail in the following sections of this report.

TABLE 1

AIR QUALITY INDEX - 1988

HOURLY FREQUENCY DISTRIBUTION

STATION/ LOCATION	POLLUTANT	0-15 VERY GOOD	16-31 GOOD	32-49 MODERATE	50-99 POOR	100- VERY POOR
26029	SO2	8629	0	0	0	0
	COH	3948	370	78	2	0
KITCHENER	O3	7686	485	172	0	0
	NO2	8178	3	0	0	0
	CO 1 hr	8313	0	0	0	0
	CO 8 hr	8352	0	0	0	0
	API	1598	347	0	0	0
26045	SO2	5077	0	0	0	0
	COH	4908	25	0	0	0
WATERLOO	O3	4458	388	76	1	0
	API	4764	26	0	0	0
28028	SO2	8386	0	0	0	0
	COH	7699	35	1	0	0
GUELPH	O3	7682	496	138	0	0
	API	4952	25	0	0	0
27067	SO2	8280	0	0	0	0
	COH	8384	63	2	0	0
ST.CATHARINES	O3	7350	608	123	0	0
	NO2	6139	0	0	0	0
	CO 1 hr	7311	0	0	0	0
	CO 8 hr	7330	1	0	0	0
	API	8298	123	0	0	0
27056	SO2	8565	0	0	0	0
	COH	8570	47	0	0	0
NIAGARA	O3	4258	463	195	12	0
FALLS	API	8295	307	0	0	0
29000	SO2	8539	1	0	0	0
	COH	7900	583	82	2	0
HAMILTON	O3	8222	402	136	8	0
DOWNTOWN	NO2	8566	4	0	0	0
	CO 1 hr	8564	0	0	0	0
	CO 8 hr	8583	0	0	0	0
	TRS	8396	133	18	0	0
	API	6990	1520	40	0	0
29105	SO2	8479	0	0	0	0
	COH	8025	153	18	0	0
HAMILTON	O3	7767	479	103	5	0
EAST	API	4932	53	0	0	0
29114	SO2	8465	0	0	0	0
	COH	8156	195	9	0	0
HAMILTON	O3	7854	443	151	5	0
MOUNTAIN	TRS	7721	160	26	0	0
	API	4931	122	0	0	0
29118	SO2	6647	0	0	0	0
	COH	7231	460	36	0	0
HAMILTON	O3	7900	428	186	10	0
WEST	NO2	8266	2	0	0	0
	API	4515	449	0	0	0

DATA ANALYSIS

Niagara Falls

Sulphur dioxide and soiling index concentrations at the Allendale Avenue AQI station 27056 (Figure 2 and Table 2) were low and met all objectives. Figures 3 and 4 show the yearly trends for these two parameters dating back to 1980. Little change in levels is evident although soiling index did increase somewhat in 1988.

The pollution rose given in Figure 5 for sulphur dioxide shows marginally higher levels from the southwest and southeast, probably from distant industrial sources. For soiling index in Figure 6, highest levels were from the southeast quadrant. This may indicate a small influence of traffic in the Falls tourist area.

Ozone monitoring began in May, 1988, so as to be part of the new AQI. Due to an extremely hot summer, the hourly ozone objective was exceeded 207 times, with 195 hours falling in the Moderate range of the AQI and 12 hours in the Poor range.

Ozone is a photochemical product of the chemical reaction between nitrogen oxides and certain hydrocarbons in the presence of sunlight. The pollution rose given in Fig. 7 shows highest average concentrations arrived from the southwest and were largely imported from the Ohio Valley in United States. This is confirmed by a station at Long Point, upwind of all Canadian sources, which measured over 560 hours above the objective in 1988. At the peak times, levels were high throughout Southern Ontario. The pollution rose does not adequately indicate this because the long-term averaging of the rose flattens out peak periods. Southerly winds do not automatically yield high ozone, even during the summer.

TABLE 2

SUMMARY STATISTICS - NIAGARA FALLS

CONTINUOUS POLLUTANTS

27056 - ALLENDALE AVE

POLLUTANT	ANNUAL AVERAGE 1986	1987	1988	1988 MAXIMUM 1 HR	24 HR	OBJECTIVE 1 HR	24 HR	1 YR	NO.TIMES OVER OBJECTIVE(1988) 1 HR	24 HR	1 YR
SULPHUR DIOXIDE SO2(ppm)	0.003	0.002	0.005	0.09	0.04	0.25	0.10	0.02	0	0	0
SOILING INDEX COH(COH'S)	0.18	0.20	0.32		0.9		1.0	0.5		0	0
OZONE O3 (ppb)	-	-	[1]27.6	139		80			207		

[1] 7 months of data. Installed in June 1988.

SUMMARY STATISTICS - NIAGARA FALLS

CONTINUOUS POLLUTANTS NEAR GENERAL ABRASIVE LTD.

27055 - STANLEY AVE

POLLUTANT	ANNUAL AVERAGE 1986	1987	1988	1988 MAXIMUM 1 HR	24 HR	OBJECTIVE 1 HR	24 HR	1 YR	NO.TIMES OVER OBJECTIVE(1988) 1 HR	24 HR	1 YR
SULPHUR DIOXIDE SO2(ppm)	0.008	0.006	0.011	0.18	0.10	0.25	0.10	0.02	0	0	0
SOILING INDEX COH(COH'S)	0.34	0.35	0.40		1.2		1.0	0.5		4	0
TOTAL REDUCED SULPHUR (TRS) (ppb)	1.2	2.8	4.1	67		20(H2S)			273 776 hours > 10ppb		

SUSPENDED PARTICULATES - micrograms per cubic metre

ONT.OBJECTIVES: 120 (24 hour)
60 (annual geo.mean)

STATION	GEOMETRIC MEAN 1986	1987	1988	1988 MAXIMUM 24 HR	NO.OF SAMPLES	NO.TIMES OVER OBJECTIVE(1988) 24 HR	1 YR	SOURCE MONITORED
27056 ALLENDALE AV	42	44	43	116	57	0	0	AMBIENT
27055 STANLEY AV	81	85	95	392	55	16	1	GENERAL ABRASIVES
27050 VICTORIA AV	[1]90	73	80	188	55	12	1	CYANAMID

[1] Station moved to 27050 from 27053(First & Bridge) in early 1986.

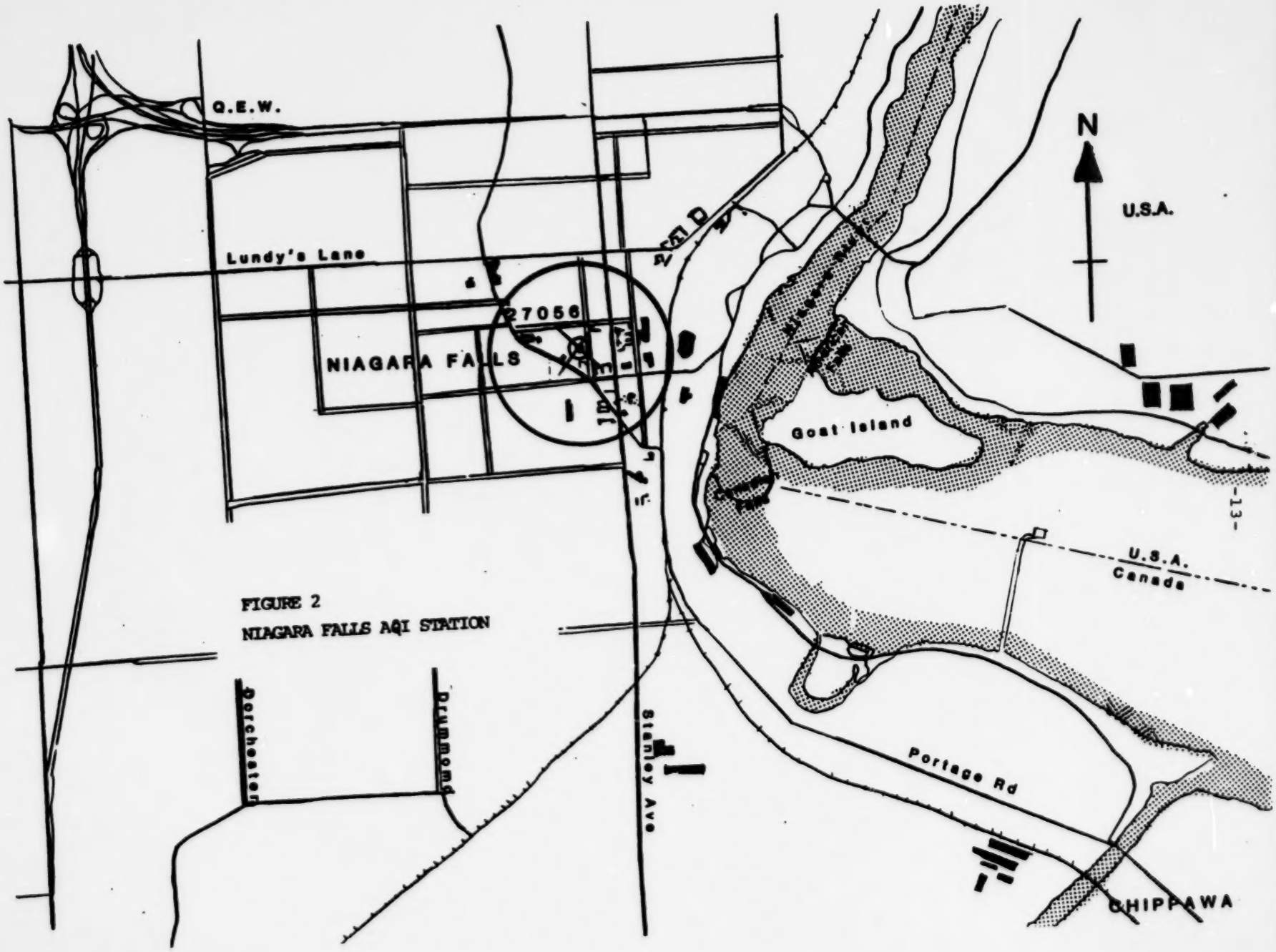


FIGURE 2
NIAGARA FALLS AQI STATION

FIGURE 3

SULPHUR DIOXIDE YEARLY TREND

27049/27056 NIAGARA FALLS 1980 – 1988

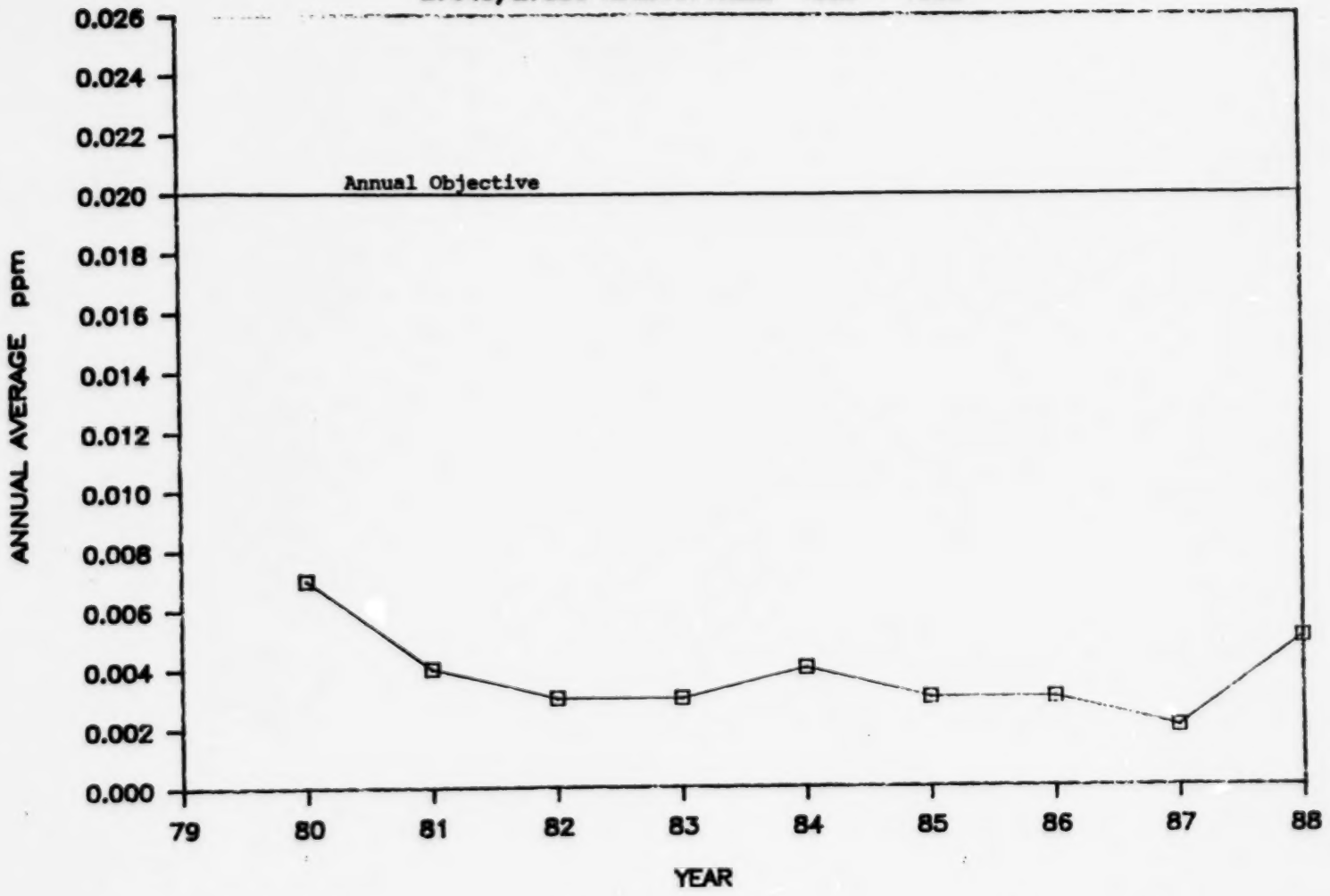
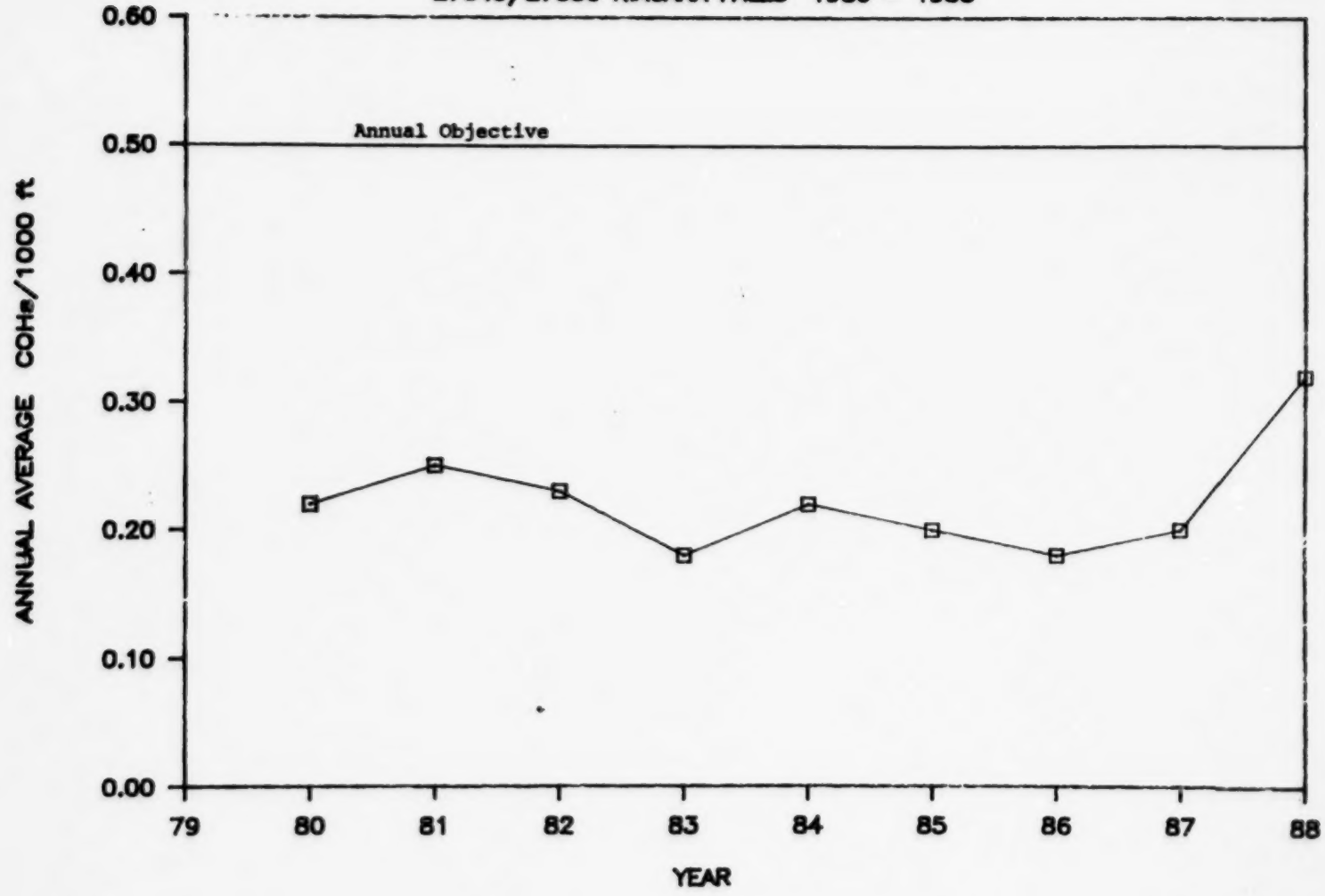
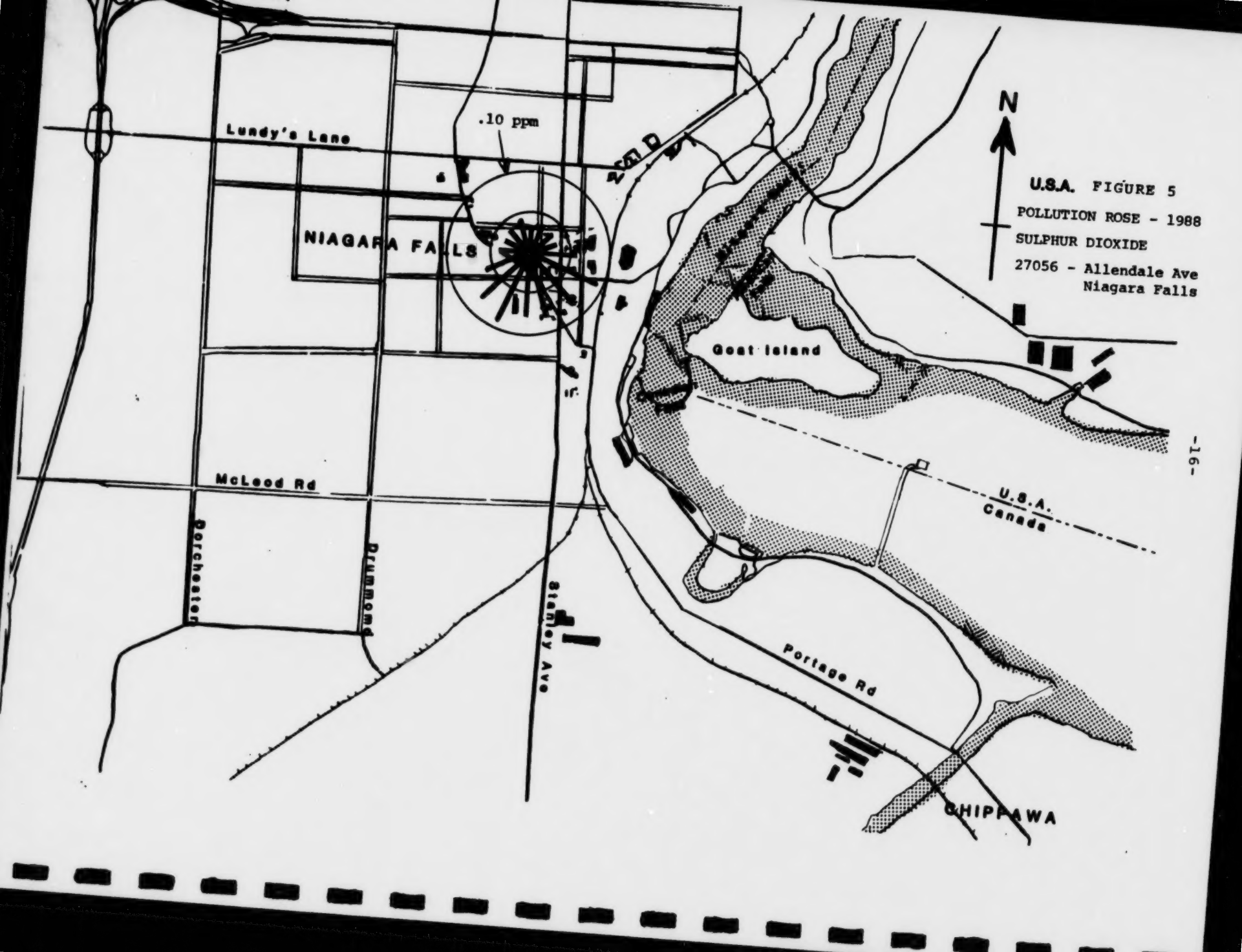


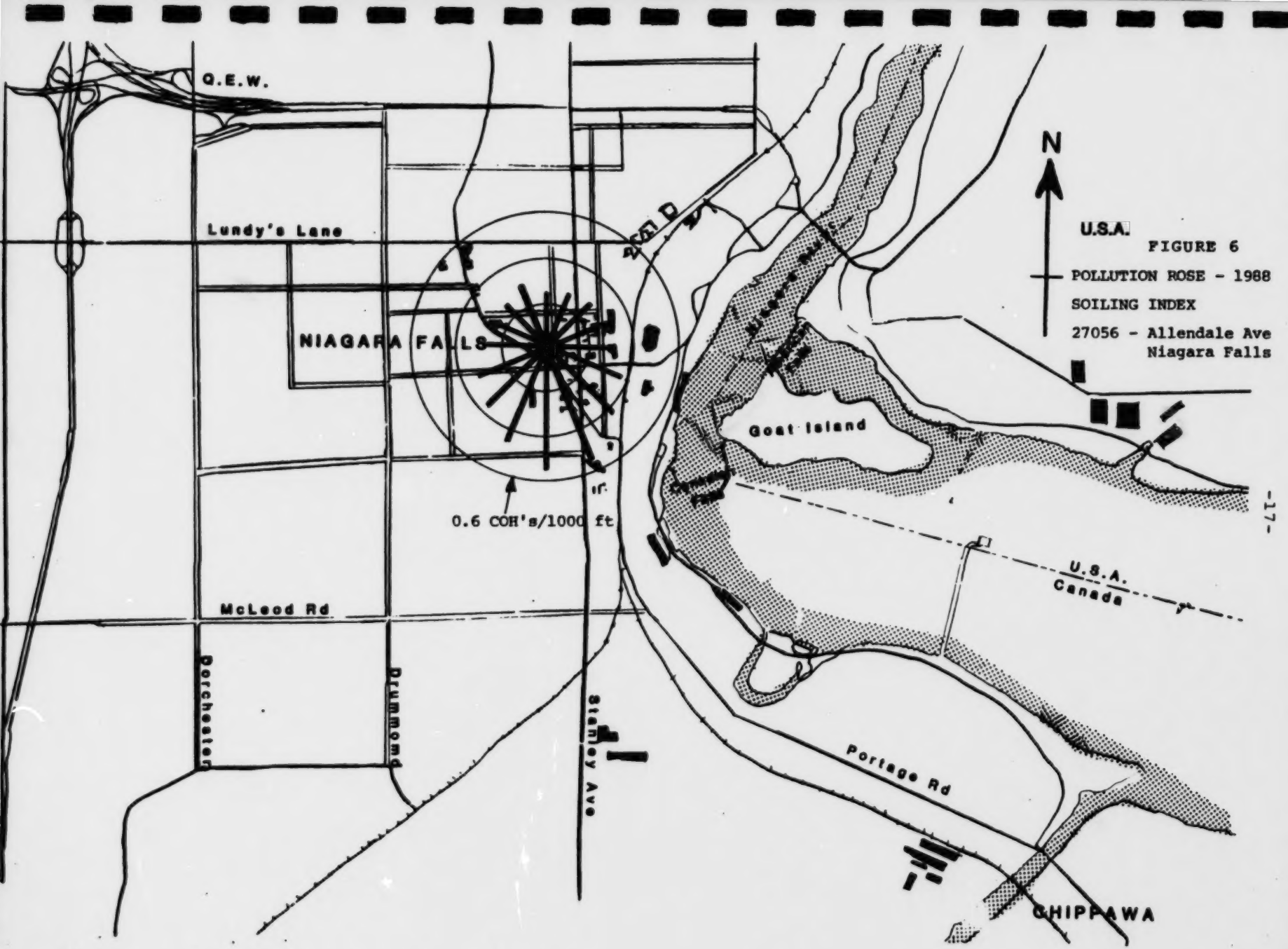
FIGURE 4

SOILING INDEX YEARLY TREND

27049/27056 NIAGARA FALLS 1980 – 1988




N
U.S.A. FIGURE 5
POLLUTION ROSE - 1988
SULPHUR DIOXIDE
27056 - Allendale Ave
Niagara Falls
.10 ppm
Lundy's Lane
NIAGARA FALLS
McLeod Rd
Dorchester
Drummond
Stanley Ave
Goat Island
U.S.A.
Canada
Portage Rd
CHIPPAWA


Q.E.W.
Lundy's Lane
NIAGARA FALLS
0.6 COH's/1000 ft
McLeod Rd
Dorchester
Drummond
Stanley Ave
Portage Rd
CHIPPAWA
Goat Island
U.S.A.
Canada
N
U.S.A.
FIGURE 6
POLLUTION ROSE - 1988
SOILING INDEX
27056 - Allendale Ave
Niagara Falls

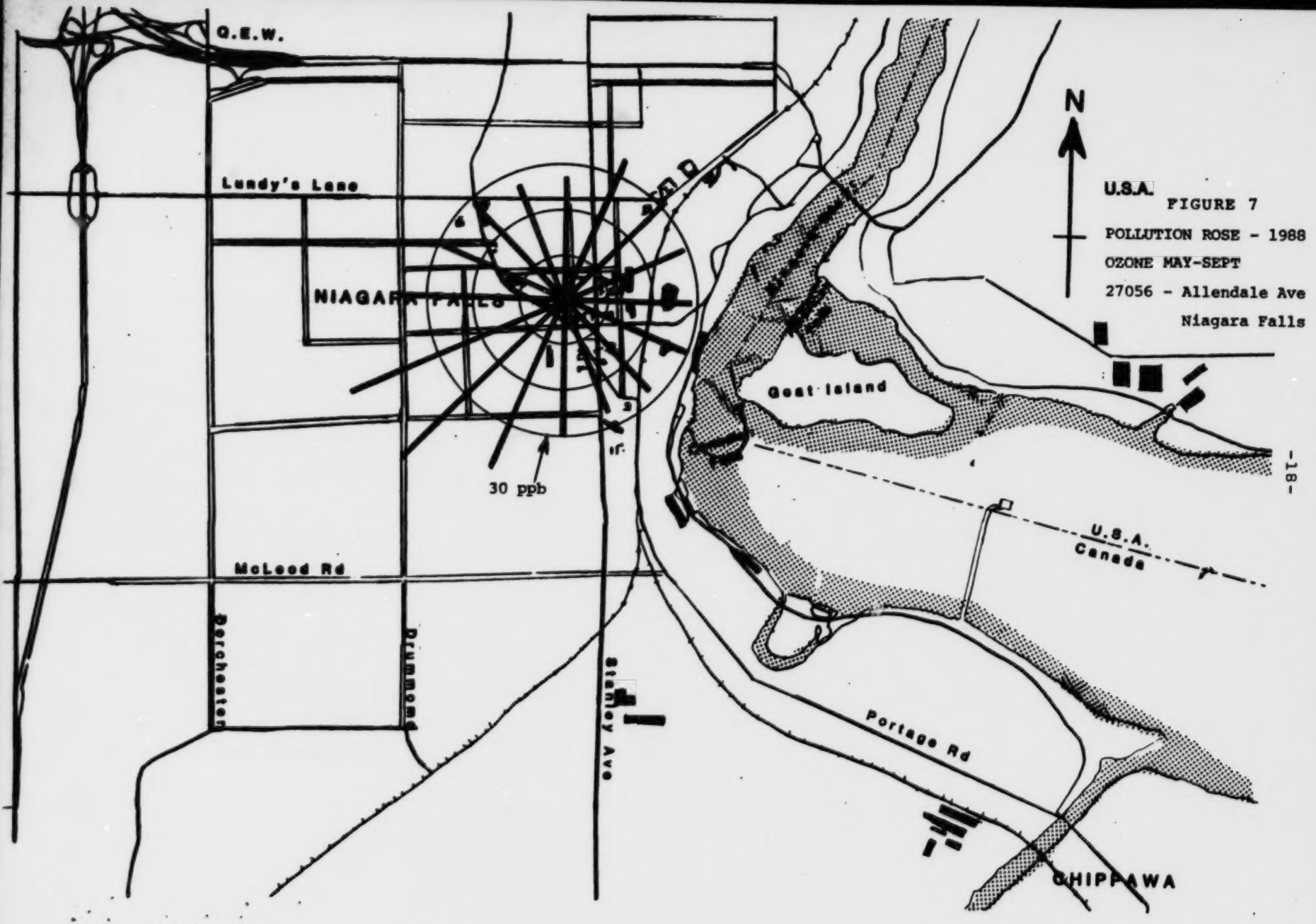


FIGURE 7

POLLUTION ROSE - 1988

OZONE MAY-SEPT

27056 - Allendale Ave

Niagara Falls

Specific meteorological conditions are necessary, namely hot, sunny weather. The summer of 1988 was very hot and resulted in much higher ozone levels throughout Southern Ontario than in previous years.

The 207 excessive hourly readings were the most measured at the 9 West Central Region AQI stations. Nearby St. Catharines measured 123 hours. The higher Niagara Falls levels may be due to the fact that the station lies directly below Ontario Hydro high tension wires. These wires are known to generate ozone. Studies are being carried out to verify this phenomenon.

Suspended particulates (TSP) at station 27056 were generally low and met the yearly and daily objectives (Table 2). The trend of TSP dating back to 1980 is given in Figure 8 and shows a gradual decline in levels since that time to well below the yearly objective.

Station 27055 at Stanley St., Niagara Falls, monitored General Abrasive Ltd., (Figure 9). The station lies 500 metres northeast of the company and contains sulphur dioxide (SO_2) and total reduced sulphur (TRS) continuous analyzers, a soiling index tape sampler and a hi-vol.

The data for SO_2 are summarized in Table 2 and show mostly low levels. All objectives for sulphur dioxide were met, although an increase in levels occurred in 1988. In the case of TRS, a severe deterioration was noted. There were 273 hours in which the objective for hydrogen sulphide was exceeded (Table 2), compared to 131 in 1987. The data can also be compared to the 10 ppb level - an approximate odour threshold for hydrogen sulphide. There were 776 hours above this level in 1988, compared to 481 in 1987. Figure 10 depicts a severe deterioration in TRS measured since 1986 which was mainly due to a deterioration of pollution control equipment at General Abrasives caused by the corrosive nature of the emissions.

FIGURE 8

SUSPENDED PARTICULATE YEARLY TREND

27049/27056 NIAGARA FALLS 1980–1988

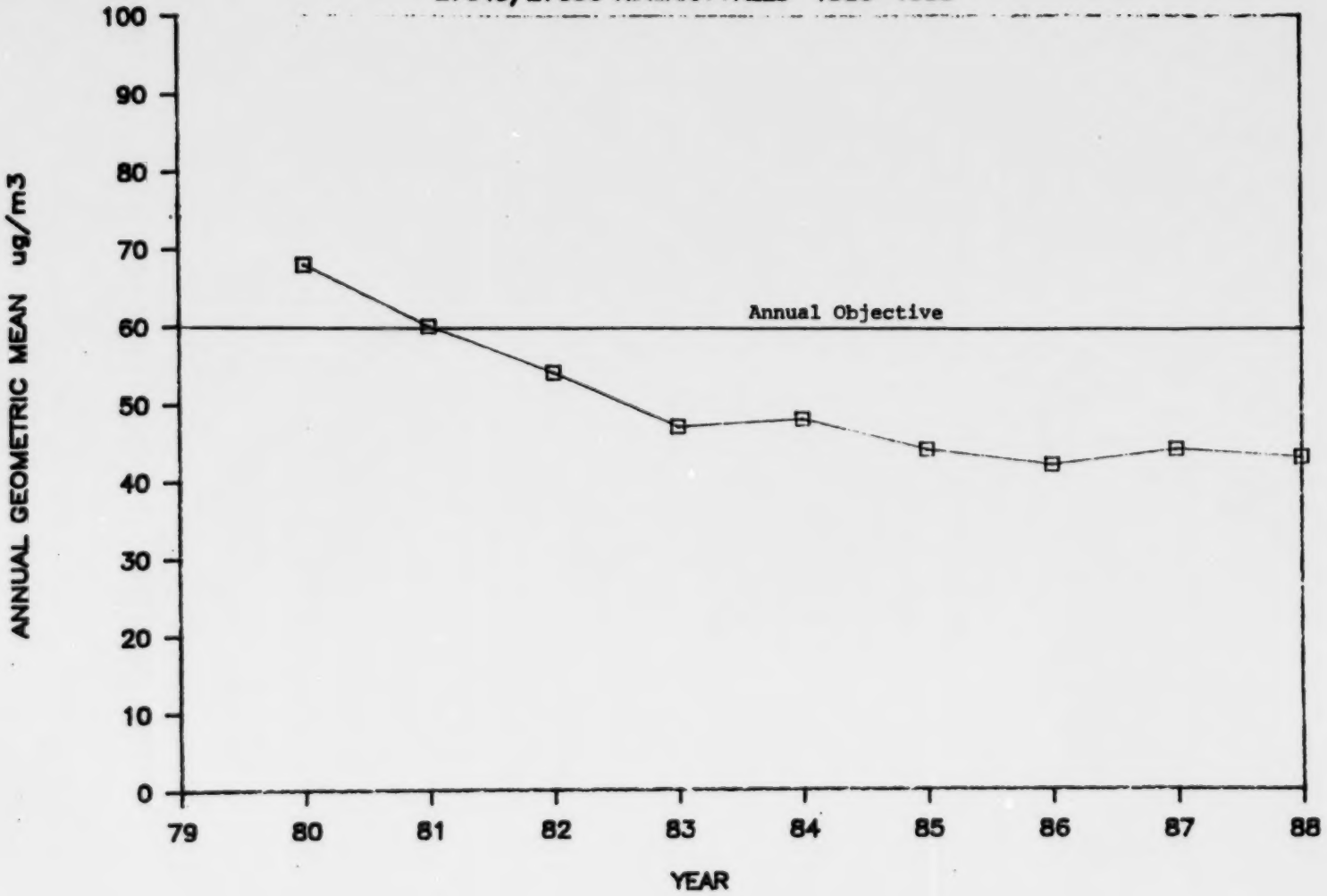


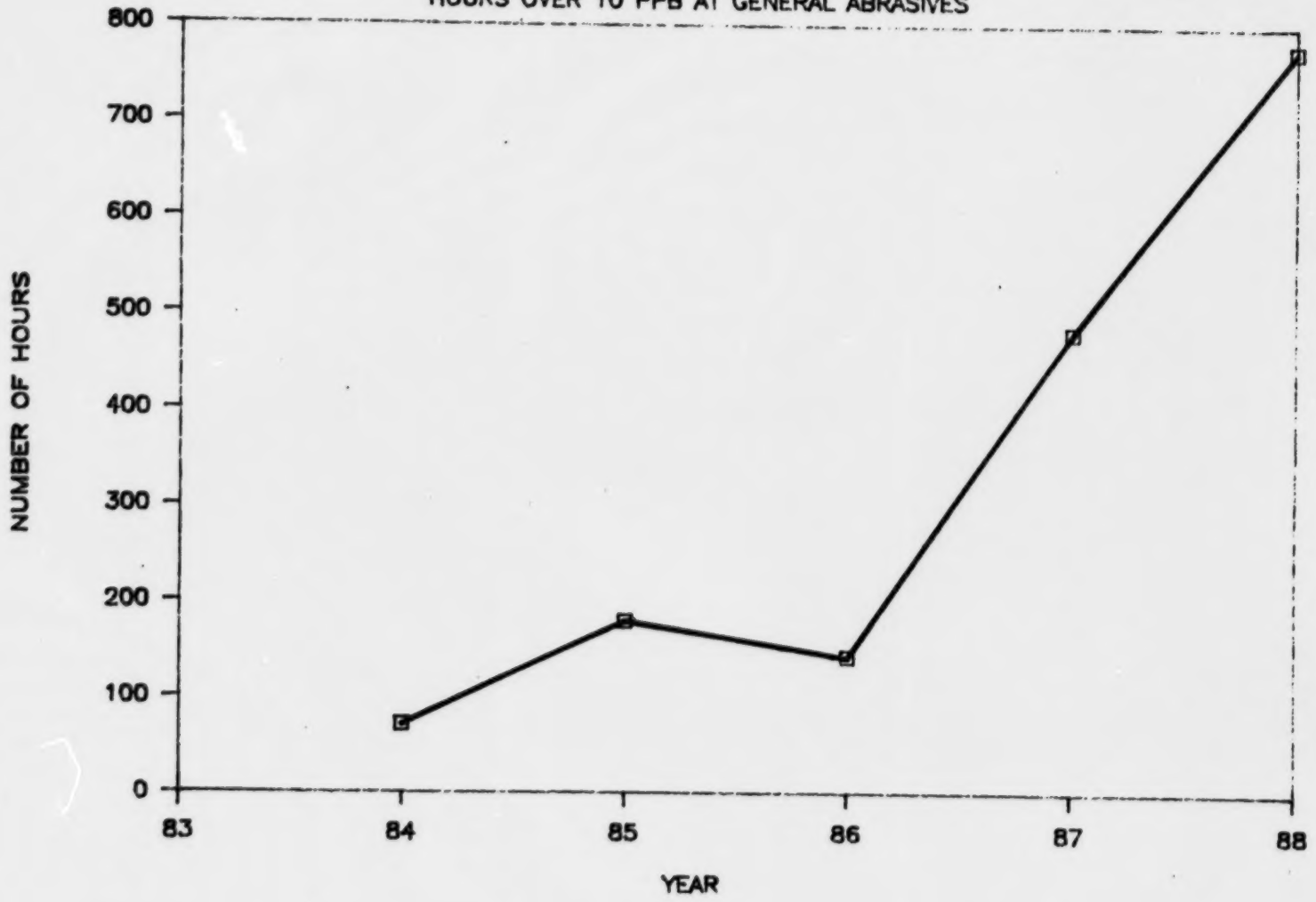
FIGURE 9

NIAGARA FALLS INDUSTRY STATIONS

FIGURE 10

TRS EXCEEDENCE TREND – NIAGARA FALLS

HOURS OVER 10 PPB AT GENERAL ABRASIVES



The pollution roses in Figures 11 and 12 confirm that General Abrasives was the primary source of both pollutants as both roses show peaks under southwest winds. For sulphur dioxide, an equal effect was noticed from nearby Cyanamid to the southeast.

The major sources of odours at the General Abrasives plant are the silicon carbide furnaces. The company has conducted stack testing and is continuing to modify their control system which consists of a baghouse and incinerator for control of dust and TRS. The control system when installed in 1985, was a new design concept. However, modifications were required and in 1988 the company began a voluntary control program scheduled to be completed in 1989. This includes improved capture and incineration of furnace gases to reduce stack emissions of TRS. This has been effective, however, subsequently in 1989, it was determined that emissions through holes in the geodesic domes were also a significant source. These holes were caused by the corrosive gases from the furnaces. The company has committed to an improved maintenance program for these domes, as well as implementing operational changes to limit fugitive emissions.

The hi-vol at station 27055 (Stanley St.) measuring suspended particulates continued to show unacceptably high levels. The yearly mean increased to 95 ug/m^3, well above the objective of 60, and 16 out 55 samples (29%) exceeded the daily objective of 120 ug/m^3 compared to 16% in 1986 (Table 2). The data correlated weakly with southwest winds, indicating that General Abrasives may have been a source of the dust. However, fugitive dust emissions from traffic and unpaved lots near the station are suspected as being more important contributors to the readings. In addition, Ontario Hydro has been conducting extensive construction near the station throughout 1988 and 1989. Much higher summer levels, particularly in drought stricken June/July, attest to this.

FIGURE 11

POLLUTION ROSE - 1988

SULPHUR DIOXIDE

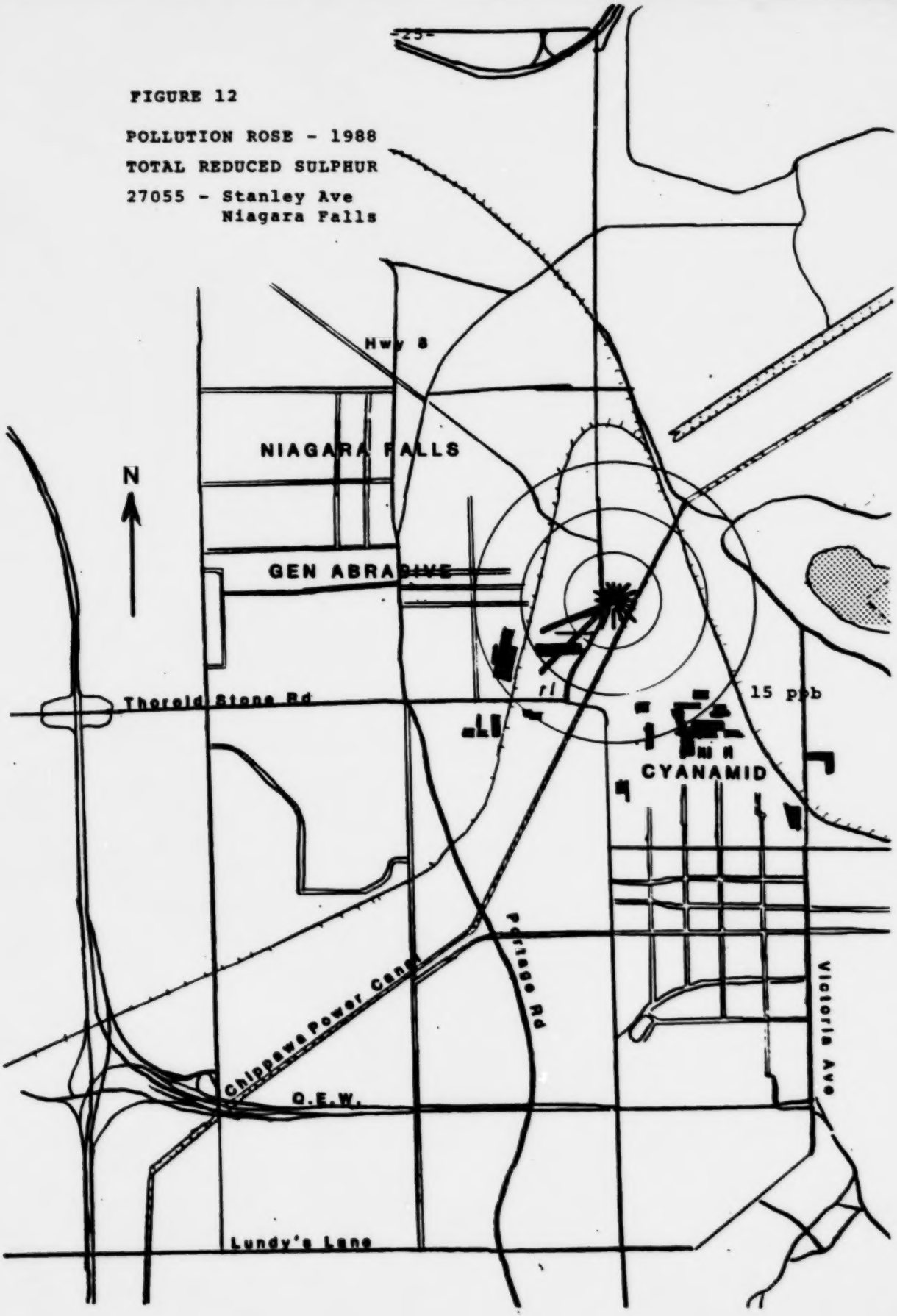
27055 - Stanley Ave
Niagara Falls

FIGURE 12

POLLUTION ROSE - 1988

TOTAL REDUCED SULPHUR

27055 - Stanley Ave
Niagara Falls



The sources of dust emissions at General Abrasives are the raw material and product handling operations. Some uncontrolled operations were directed into the existing control systems in 1988. Alarm systems were also installed on dust collection systems to advise operators of emission problems. Other sources of dust are fugitive in nature such as blow off from roads, trucks, unpaved lots, etc.

The soiling index tape sampler at 27055 (Stanley St.), which measures much finer particles than the hi-vol, showed low concentrations (Table 2). The daily objective was not exceeded and the yearly average was well below the objective. The pollution rose in Figure 13 indicates a small contribution of fine particles from General Abrasive under southwest winds, however, equivalent levels came from the southeast quadrant, indicating Cyanamid may be a minor source.

Dust fallout in this area would appear to consist primarily of larger particles affecting a very localized area.

Suspended particulates were measured at Station 27050 on Victoria Avenue 500 metres east of Cyanamid (Figure 9). In 1988, the yearly mean increased to 80 ug/m^3 (from 73) and 12 samples out of 55 exceeded the daily objective compared to 5 in 1987. As mentioned, the soiling index sampler at station 27055 northwest of the plant also seemed to show a small impact from Cyanamid (Figure 13).

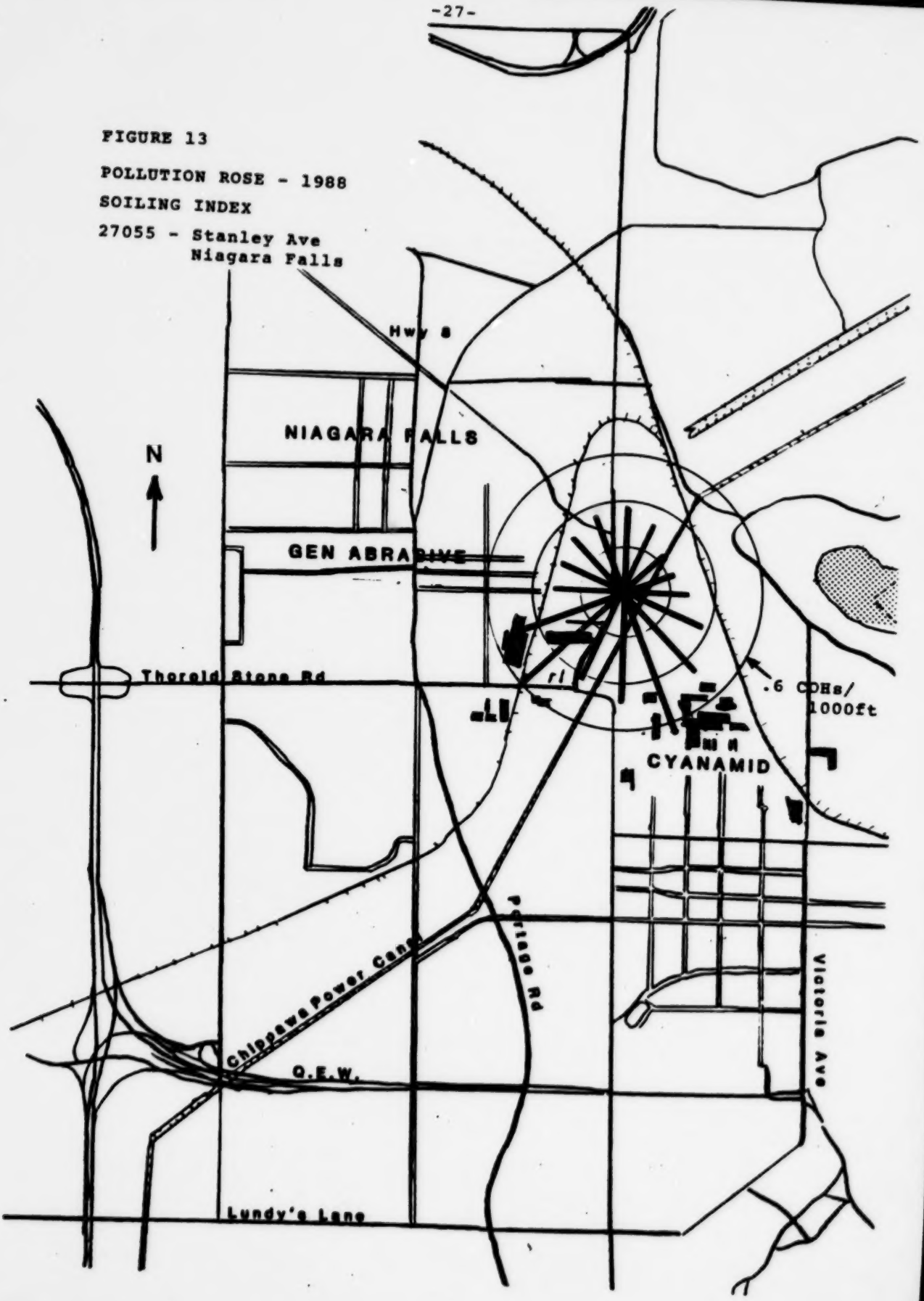
The major sources of dust from Cyanamid are the calcium carbide furnace and its product handling system. In 1988 an additional source of dust resulted from the recommissioning of a previously approved calcium carbide furnace. Other sources include blow off from outdoor storage piles of raw materials. The company has installed additional dust collection systems to control product handling emissions from the unloading of the furnaces. Also, the company is

FIGURE 13

POLLUTION ROSE - 1988

SOILING INDEX

27055 - Stanley Ave
Niagara Falls



reviewing the feasibility of reducing the use of the emergency flare stack system. Finally, a maintenance program for control equipment acceptable to the Ministry is being implemented for any new Certificate of Approval.

Despite the station's proximity to Cyanamid, correlations of suspended particulate readings with wind direction did not indicate Cyanamid to be the only source of dust. Three different wind directions correlated weakly with the TSP data. It is likely that other fugitive dust sources nearby contributed to the readings. These sources include an adjacent helicopter landing pad and other nearby unpaved areas.

Chippawa

Station 27051 at Norton and Portage, 200 metres northeast of the Norton Company (Figure 14) contained SO_2 and TRS analyzers and a hi-vol. Dustfall measurements were also made in the area. Unfortunately, the trailer housing the instruments at 27051 became inoperable in mid-1988 and the station had to be shut down in June.

Station 27051 was relocated in 1989, to the Niagara Parks Commission property, just a short distance from the old trailer site. The hi-vol has also been relocated nearby.

For the limited results available, SO_2 and TRS data are summarized in Table 3. Although all SO_2 objectives were met, the one-hour objective for hydrogen sulphide (20 ppb) was exceeded 5 times. Further, the TRS data can also be compared to the 10 ppb level - an approximate odour threshold for hydrogen sulphide, and 14 hours exceeded this level. The trend graphs in Figures 15 and 16 show that the sulphur dioxide hourly objective has not been exceeded since 1982, and that TRS exceedences of 10 ppb have decreased dramatically since the early 1980's, when literally thousands

TABLE 3

SUMMARY STATISTICS - CHIPPAWA

CONTINUOUS POLLUTANTS NEAR NORTON CO.

27051 - NORTON/PORTAGE

POLLUTANT	ANNUAL AVERAGE 1986	1987	1988	1988 MAXIMUM 1 HR	24 HR	OBJECTIVE 1 HR	24 HR	1 YR	NO.TIMES OVER OBJECTIVE(1988) 1 HR	24 HR	1 YR
SULPHUR DIOXIDE SO2(ppm)	0.005	0.005	*0.007	0.08	0.03	0.25	0.10	0.02	0	0	0
TOTAL REDUCED SULPHUR (TRS) (ppb)	2.2	1.8	+1.2	51		20(H2S)			5 14 hours > 10ppb		

* 6 months of data

\+ 4 months of data

SUSPENDED PARTICULATES - micrograms per cubic metre ONT.OBJECTIVES: 120 (24 hour)
60 (annual geo.mean)

STATION	GEOMETRIC MEAN 1986	1987	1988	1988 MAXIMUM 24 HR	NO.OF SAMPLES	NO.TIMES OVER OBJECTIVE(1988) 24 HR	1 YR	SOURCE MONITORED
27051 NORTON/PORTAGE	62	58	*55	114	25	0	0	NORTON CO.

* 5 months of data

DUSTFALL - grams/square metre/30 days ONT.OBJECTIVES : 7.0(1 MONTH)
4.5(ANNUAL AVERAGE)

STATION	ANNUAL AVERAGE 1986	1987	1988	1988 MAXIMUM 1 MONTH	NO.MONTHS OVER OBJECTIVE 1986	1987	1988	SOURCE MONITORED
27005 PORTAGE/LEGION CHIPPAWA	8.2	7.1	6.4	11.8	5	6	6	NORTON CO.
27006 BRIDGEWATER CHIPPAWA	3.3	2.8	2.3	3.8	1	0	0	BACKGROUND

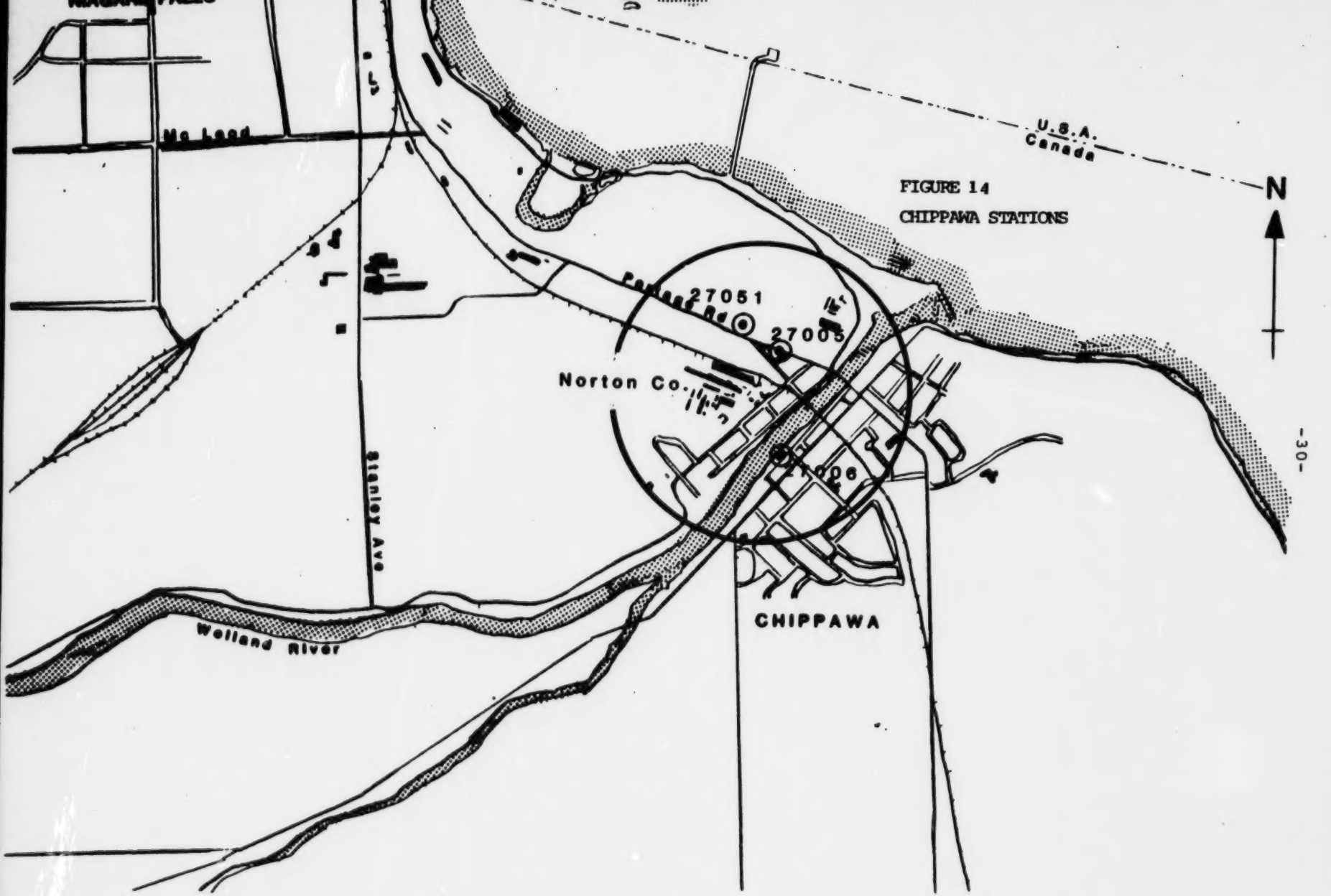


FIGURE 14
CHIPPAWA STATIONS

FIGURE 15

SO2 EXCEEDENCE TREND – CHIPPAWA

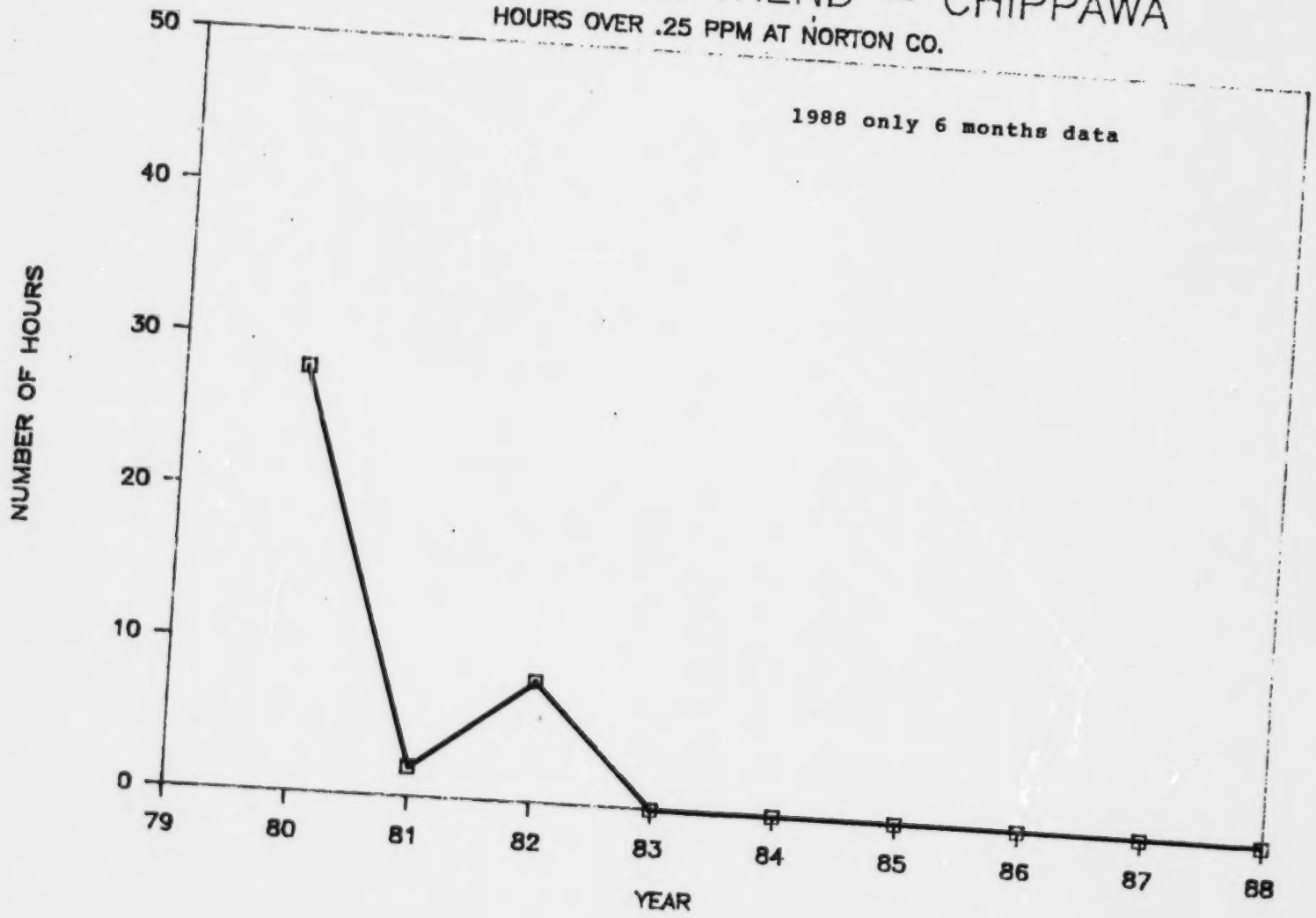
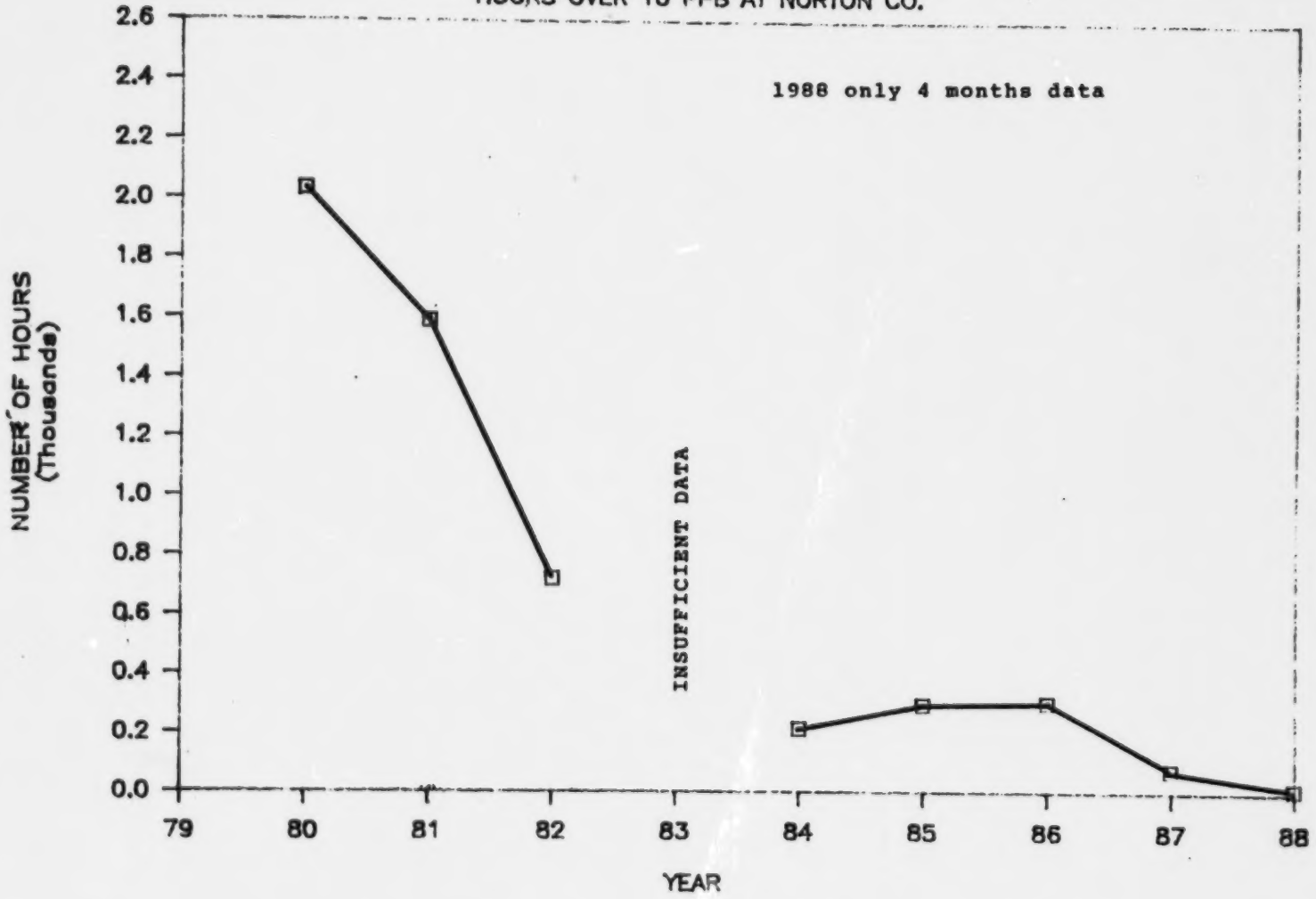


FIGURE 16

TRS EXCEEDENCE TREND – CHIPPAWA

HOURS OVER 10 PPB AT NORTON CO.



of such exceedences were routinely measured yearly. The installation of the tall stack in 1982, is largely responsible for this improvement.

Pollution roses in Figures 17 and 18 indicate a contribution of the Norton plant as both SO_2 and TRS roses show modest peaks under southwest winds. The SO_2 and TRS source at Norton is one of the aluminum oxide furnaces and its product handling system. This fugitive (non-stack) source is currently under study to determine the best method for control.

Suspended particulate concentrations were measured at Station 27051 (Table 3). The yearly mean based on only 5 months of data was 55 ug/m^3, below the yearly objective, and all 25 samples were below the daily objective. The trend graph in Figure 19 shows the huge improvements in TSP levels dating back to 1974 due to various emission control improvements made at this plant.

Dustfall near the Norton plant at 27005, Portage and Legion (Figure 14) exceeded the monthly objective in 6 out of 12 samples (Table 3). The background jar (27006) at Bridgewater and Oliver recorded much lower and acceptable levels. Similar to TSP, dustfall levels at 27005 have improved greatly since the 1970s (Figure 20) but a minor dust fallout problem still existed. The source of this problem at Norton is fugitive emissions from the raw material handling and general housekeeping. The company has provided dust collection for some of the materials handling and have re-instituted the use of a road sweeper.

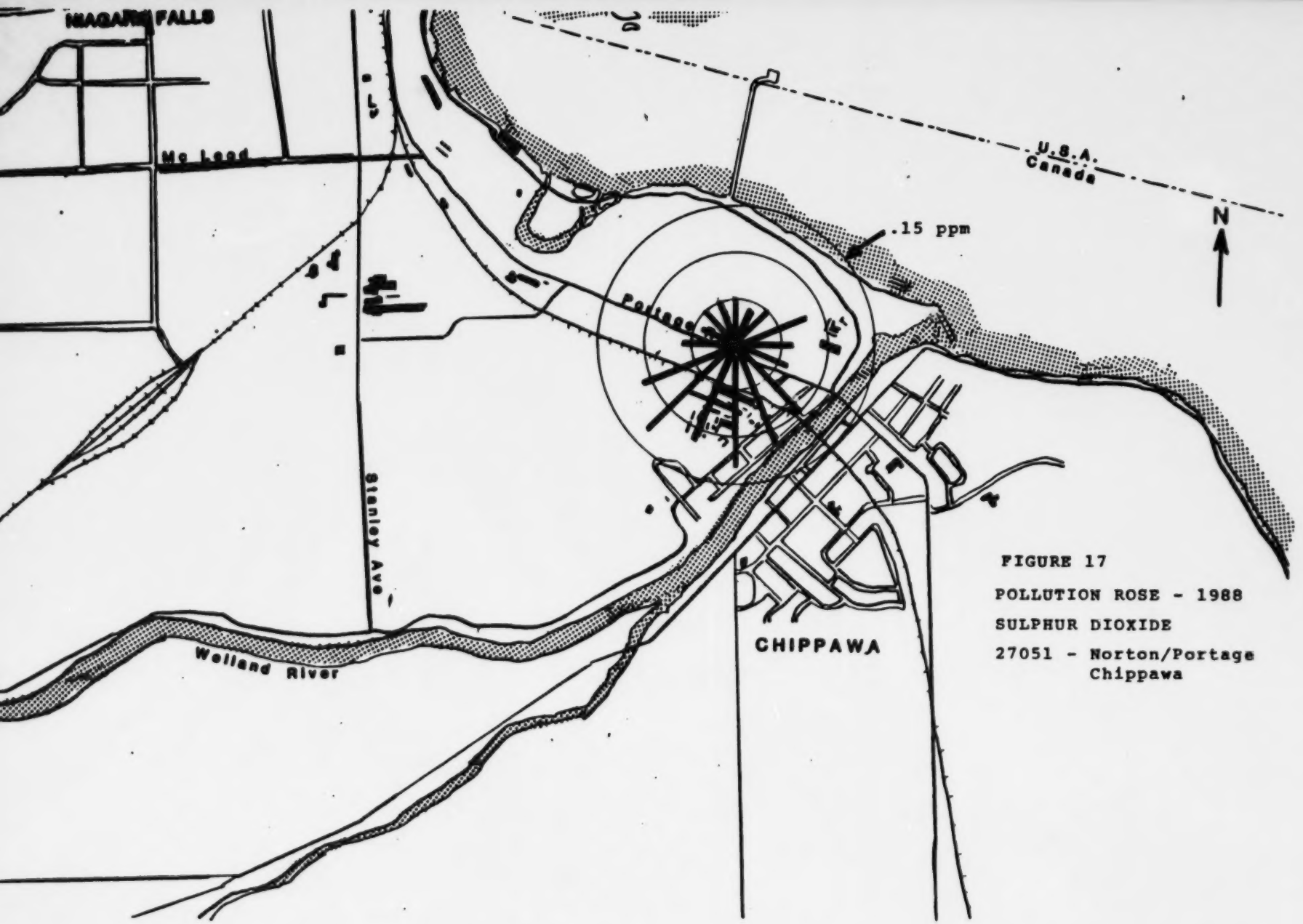


FIGURE 17

POLLUTION ROSE - 1988

SULPHUR DIOXIDE

27051 - Norton/Portage
Chippawa

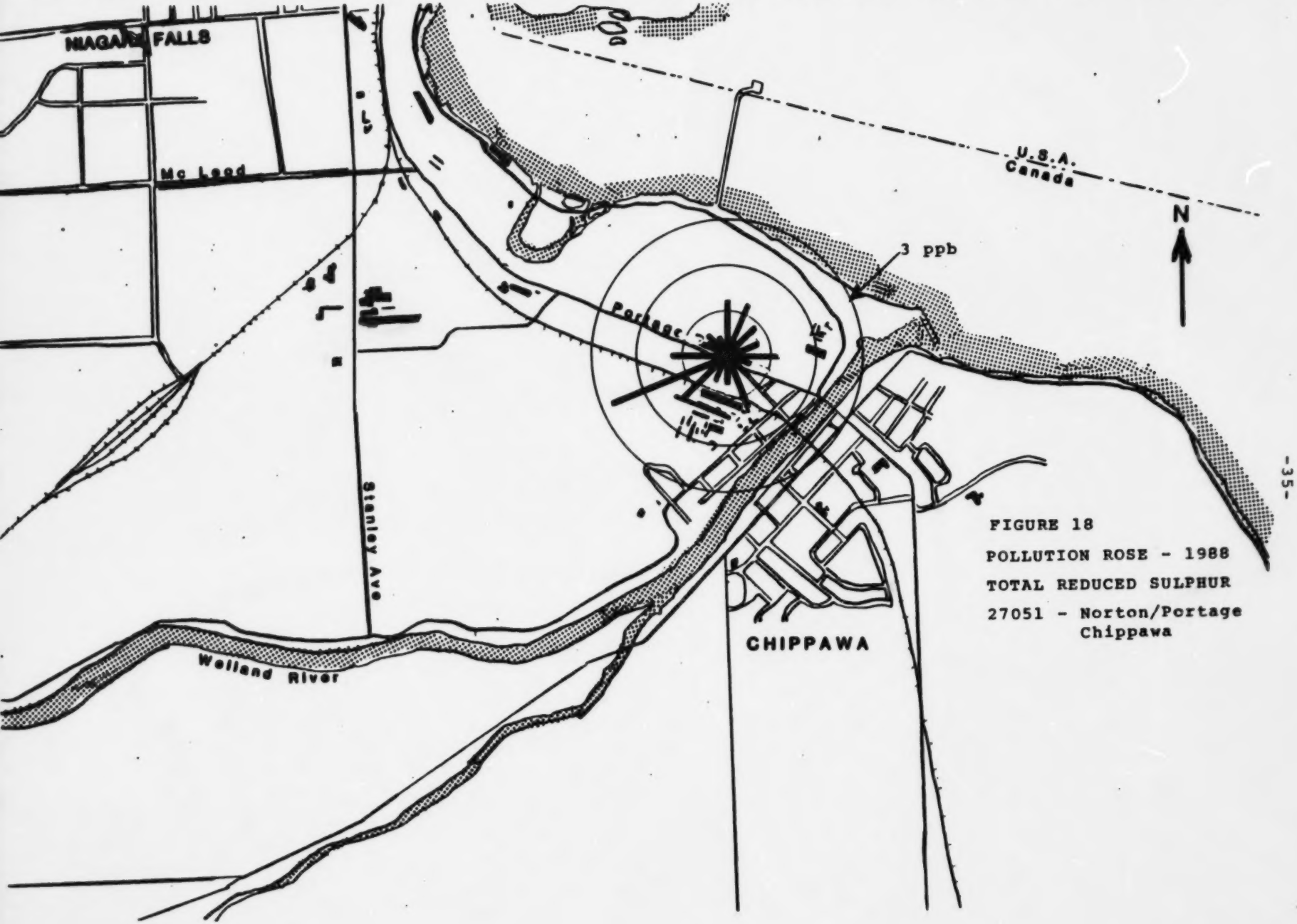


FIGURE 18

POLLUTION ROSE - 1988

TOTAL REDUCED SULPHUR

27051 - Norton/Portage
Chippawa

FIGURE 19

SUSPENDED PARTICULATE YEARLY TREND

27009/51 NORTON CO.,CHIPPAWA

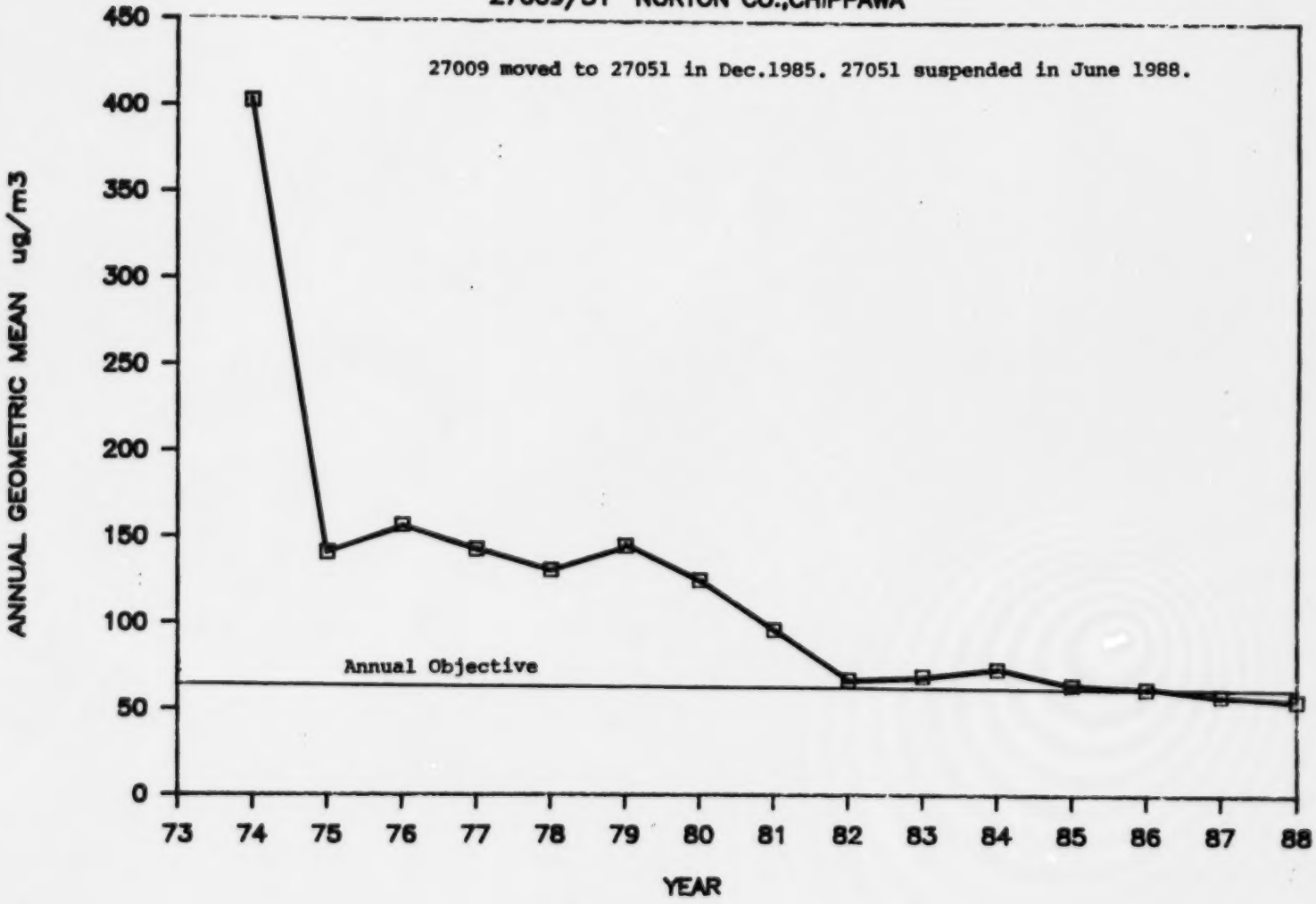
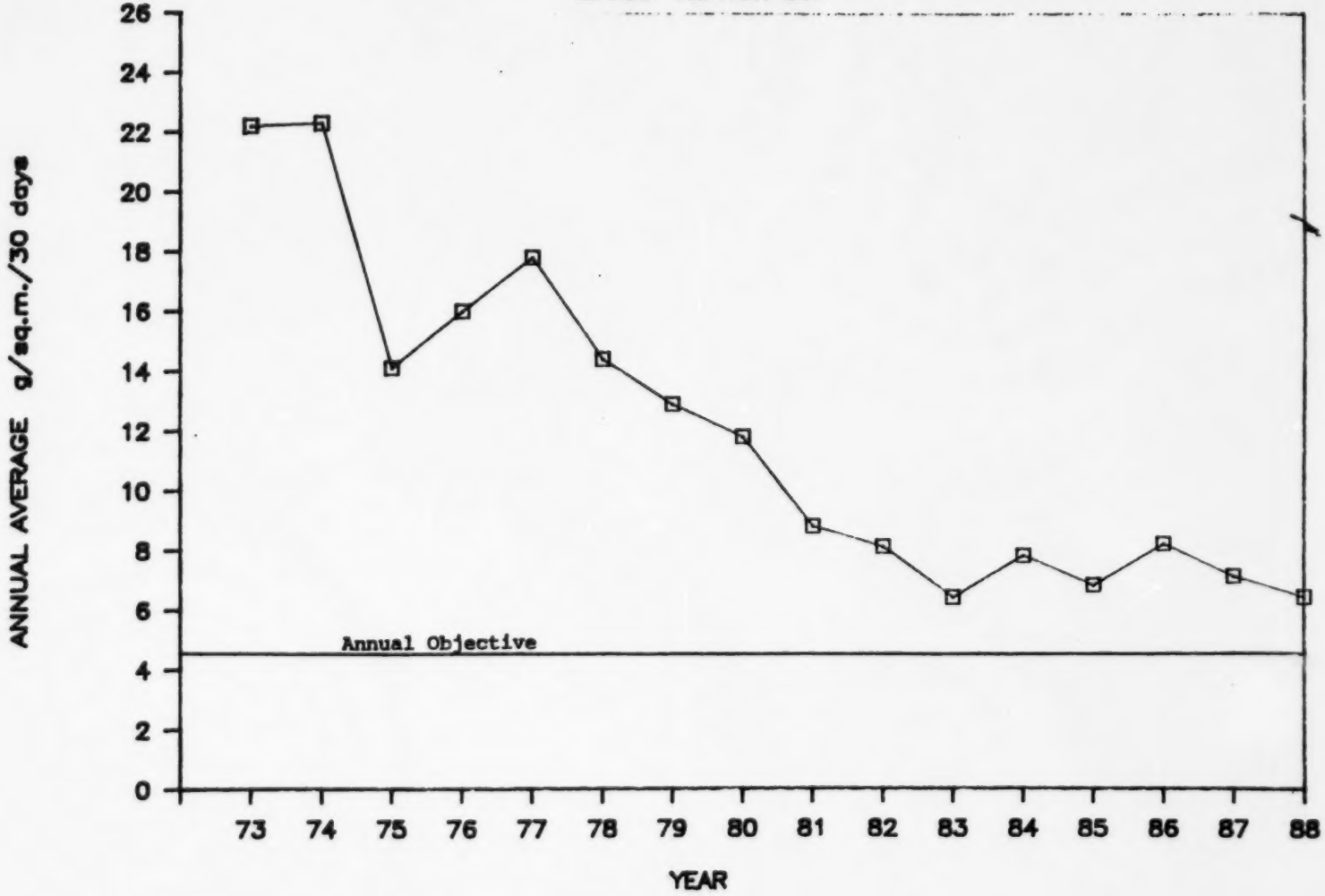


FIGURE 20

DUSTFALL YEARLY TREND – CHIPPAWA

27005 NORTON CO.



Port Colborne

Hi-vol 27047 measuring suspended particulates 350 metres north-northwest of INCO (Figure 21) recorded generally low and acceptable concentrations, similar to previous years (Table 4).

Three samples exceeded the daily objective, all during the June/July drought, indicating fugitive dust was the source. The refinery's effect on TSP levels appears to be minor as no wind direction correlated well with the data.

The samples were analyzed for nickel, and there was one excessive concentration above the objective (2 ug/m^3) although a few other nickel readings were well above normal levels, between 1 and 2 ug/m^3 (Table 4). The nickel levels correlated strongly with winds from the refinery, indicating that INCO did have an effect on the measurements.

It would appear that INCO's effect on air quality was fairly small and localized. However, past Phytotoxicology Section surveys have demonstrated nickel contamination of vegetation in the area well above guidelines. The company has purchased neighbouring properties in order to provide a buffer zone. Furnace modifications were implemented in 1987 and reduced production has further improved air quality in recent years.

The soil in the vicinity of the plant is nickel contaminated from past practices rather than current operations, and re-entrainment accounts for nickel deposition on vegetation.

St. Catharines

In September, 1986, the St. Catharines API station 27037 at North and Geneva Streets was shut down. The building in which the station was housed was sold and slated for demolition. The Ministry found a new site 1 km to the

TABLE 4

SUMMARY STATISTICS - PORT COLBORNE

PARTICULATES NEAR INCO

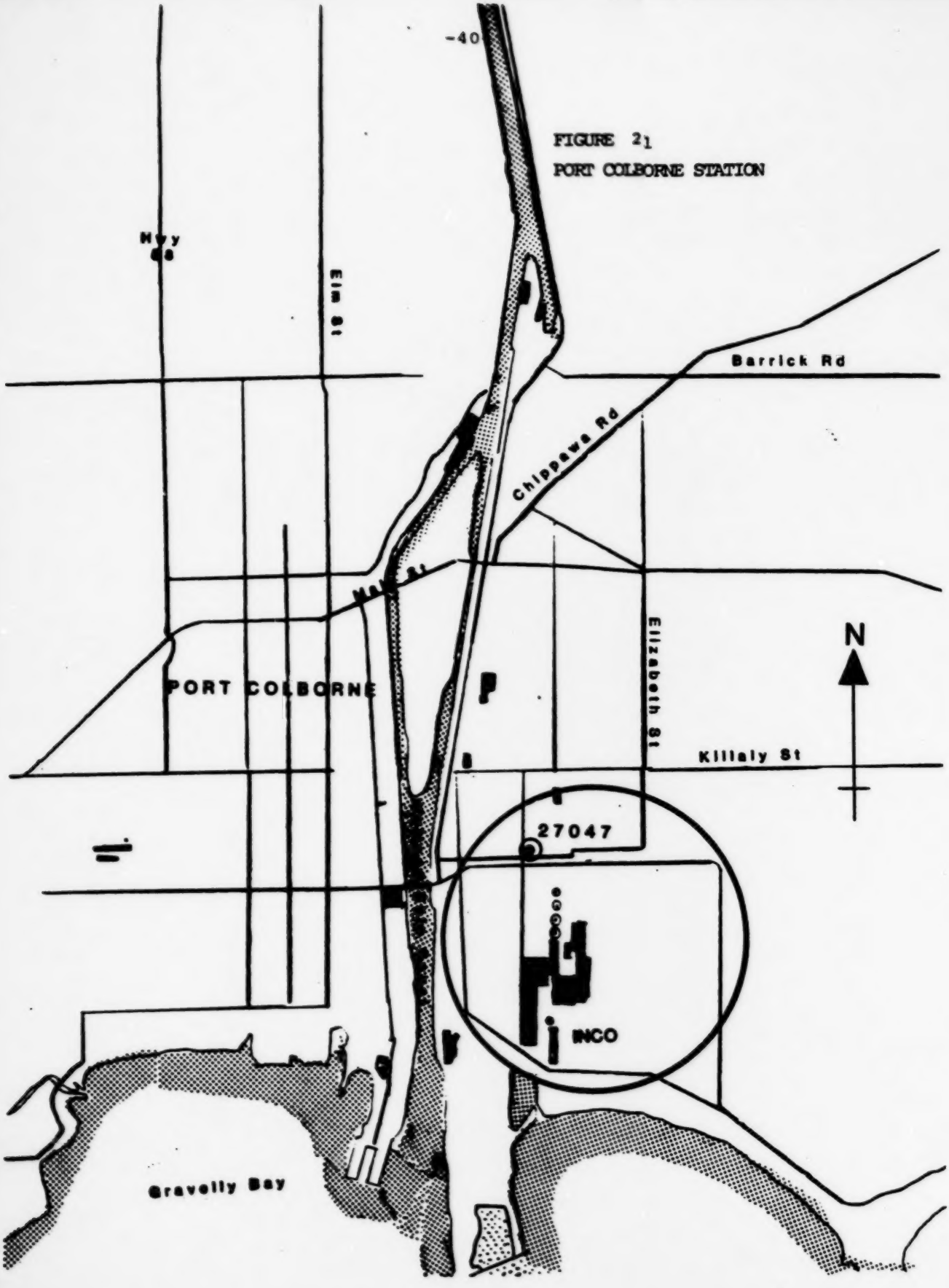
SUSPENDED PARTICULATES - micrograms per cubic metre ONT.OBJECTIVES: 120 (24 hour)
60 (annual geo.mean)

STATION	GEOMETRIC MEAN 1986	1987	1988	1988 MAXIMUM 24 HR	NO.OF SAMPLES	NO.TIMES OVER OBJECTIVE(1988) 24 HR	1 YR	SOURCE MONITORED
27047 DAVIS/FRASER	52	45	46	138	50	3	0	INCO

NICKEL IN SUSP.PARTIC. - micrograms per cubic metre ONT.OBJECTIVE: 2.0 (24 hour)

27047 DAVIS/FRASER	0.017	0.033	0.078	2.23	50	1		INCO

FIGURE 21
PORT COLBORNE STATION



southeast on Argyle Crescent, off Eastchester Ave., just outside the downtown area (Figure 22). The station is numbered 27067, and began measuring sulphur dioxide, carbon monoxide, nitrogen dioxide, ozone, soiling index and the Air Pollution Index (API) in August, 1987, and the Air Quality Index in June, 1988.

Sulphur dioxide, carbon monoxide, nitrogen dioxide and soiling index data for station 27067 are given in Table 5 and show low levels below all objectives. Trend graphs for these measurements (utilizing data from the old station 27037) in Figures 23 to 26 show low stable levels although SO_2 and CO did show marginal increases in 1988 at the new location.

Pollution roses for 27067 SO_2, CO, $NO_2$and soiling index are given in Figures 28 - 31 and show that concentrations were either uniform or peaked during southeast winds. This probably points to vehicle traffic on Eastchester Avenue and Highway 406. There were two hourly soiling index readings in the Moderate range of the AQI and both were probably due to traffic emissions.

Ozone levels exceeded the hourly standard of 80 ppb 123 times during the summer, all falling in the Moderate range of the AQI. Similar to Niagara Falls, ozone levels increased greatly in 1988 across Southern Ontario due to an extremely hot summer. Most of the elevated levels were imported from the Ohio Valley in the United States. The pollution rose is given in Figure 32 and the annual trend is shown in Figure 27.

The hi-vol at the St. Catharines AQI station was replaced by downtown Station 27008 in 1987 and recorded acceptable suspended particulate concentrations in 1988, (Table 5), with only two exceedences of the daily objective, both during the drought in June. Annual trends at this station given in

TABLE 5

SUMMARY STATISTICS - ST.CATHARINES

CONTINUOUS POLLUTANTS

* 27067 - ARGYLE CRES.& 27037 NORTH/GENEVA

* 27037 was terminated in Sept.1986 and resumed operations at 27067 in Aug.1987

ins- insufficient data in 1987

POLLUTANT	ANNUAL AVERAGE 1986	1987	1988	1988 MAXIMUM 1 HR	8 HR	24 HR	OBJECTIVE 1 HR	8 HR	24 HR	1 YR	NO.TIMES OVER OBJECTIVE(1988) 1 HR	8 HR	24 HR	1 YR
SULPHUR DIOXIDE SO2(ppm)	0.005	0.010	0.011	0.11		0.05	0.25		0.10	0.02	0		0	0
SOILING INDEX COH(COH'S)	0.24	0.27	0.23			0.8			1.0	0.5			0	0
CARBON MONOXIDE CO(ppm)	0.2	ins	1.0	8	5		30	13			0	0		
NITROGEN DIOXIDE NO2(ppm)	0.019	ins	0.018	0.08		0.05	0.20		0.10		0		0	
OZONE O3(ppb)	21.9	ins	23.6	132			80				123			

SUSPENDED PARTICULATES - micrograms per cubic metre

OBJECTIVES: 120 (24 hour)
60 (annual geo mean)

STATION +	GEOMETRIC MEAN 1986	1987	1988	1988 MAXIMUM 24 HR	NO.OF SAMPLES	NO.TIMES OVER OBJECTIVE(1988) 24 HR	1 YR
27037 NORTH/GENEVA & 27008 KING ST.	60	47	46	145	59	2	0

+ 27037 was terminated in Sept 1986 and resumed operations at 27008 in March 1987

DUSTFALL - grams/square metre/30 days

ONT.OBJECTIVE : 7.0(1 MONTH)
4.5(ANNUAL AVERAGE)

STATION	ANNUAL AVERAGE 1986	1987	1988	1988 MAXIMUM 1 MONTH	NO.MONTHS OVER OBJECTIVE 1986	1987	1988	SOURCE MONITORED
27040 - PLYMOUTH AV ST.CATHARINES	13.7	11.0	10.2	17.2	9	10	9	AIMCO FDRY
27041 - GLENDALE AV ST.CATHARINES	8.1	7.6	6.9	10.3	7	6	4	GM FDRY
27063 - GM FOUNDRY ST.CATHARINES	-	7.5	6.2	12.8		6	5	GM FDRY
27054 -CATHERINE ST ST.CATHARINES	8.8	4.4	6.1	10.3	4	1	3	BURNSTEIN CASTINGS

FIGURE 22
ST.CATHARINES STATIONS

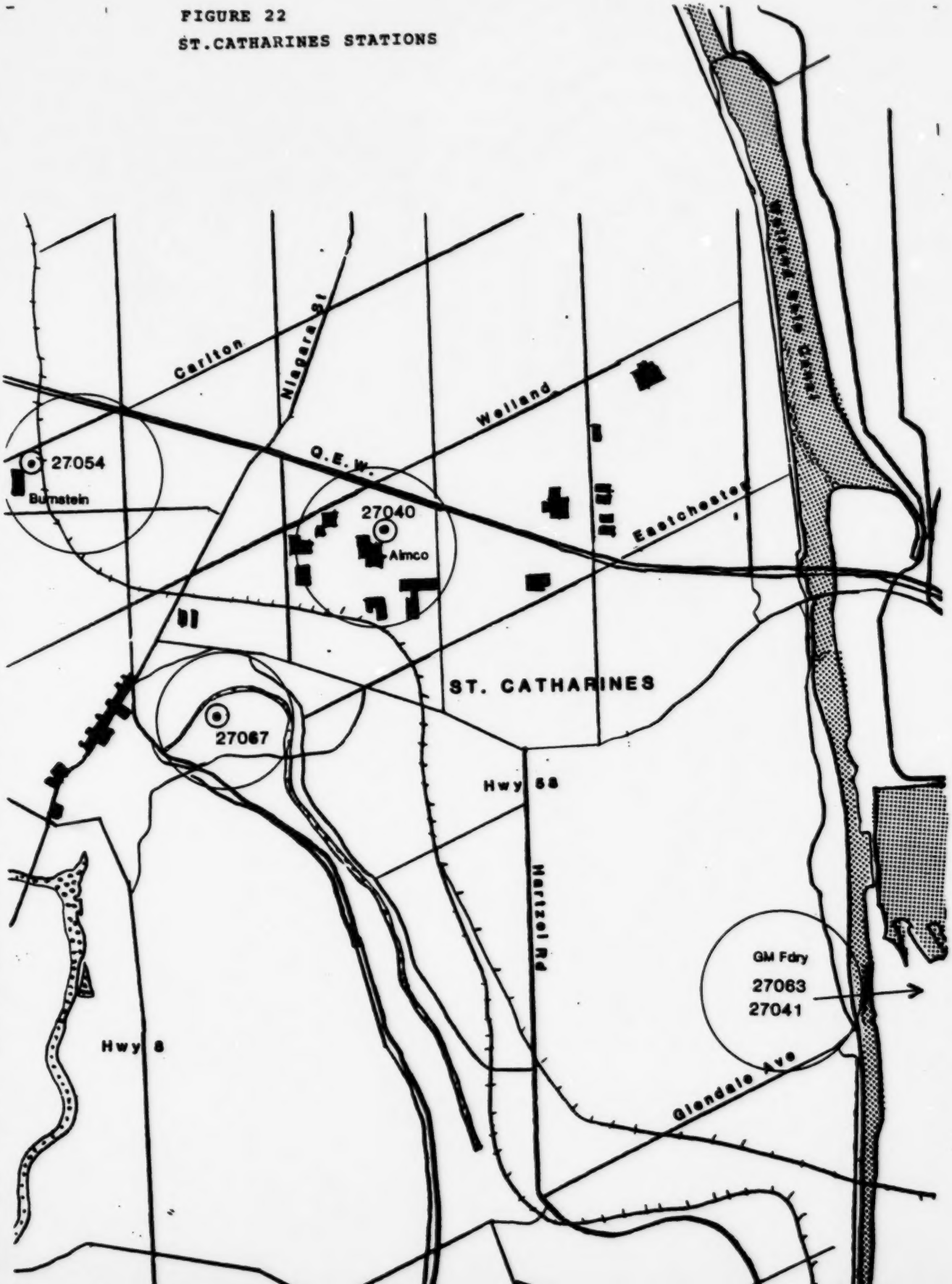


FIGURE 23

SULPHUR DIOXIDE YEARLY TREND

27037/27067 ST.CATHARINES 1977 – 1988

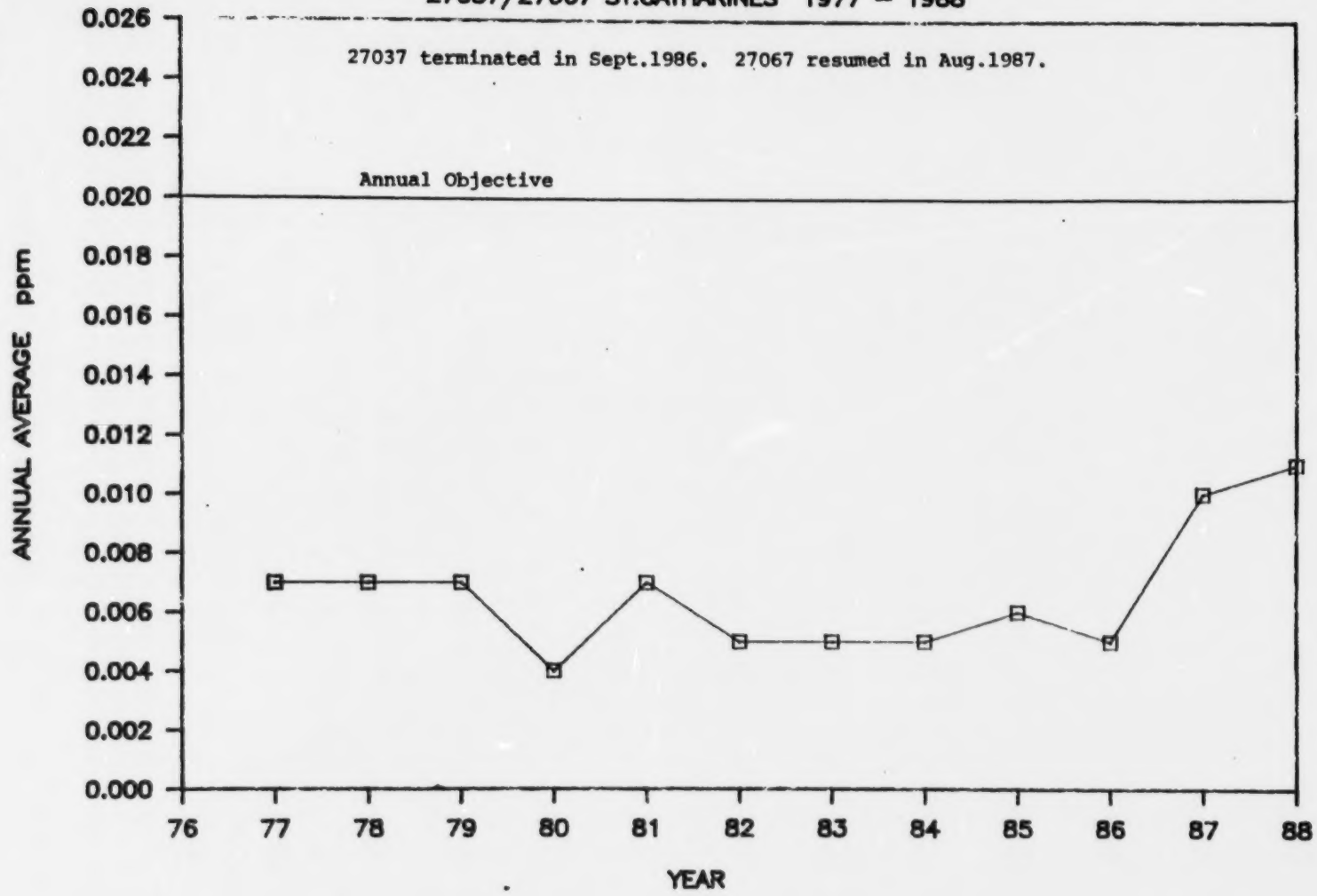


FIGURE 24

SOILING INDEX YEARLY TREND

27037/27067 ST.CATHARINES 1980 – 1988

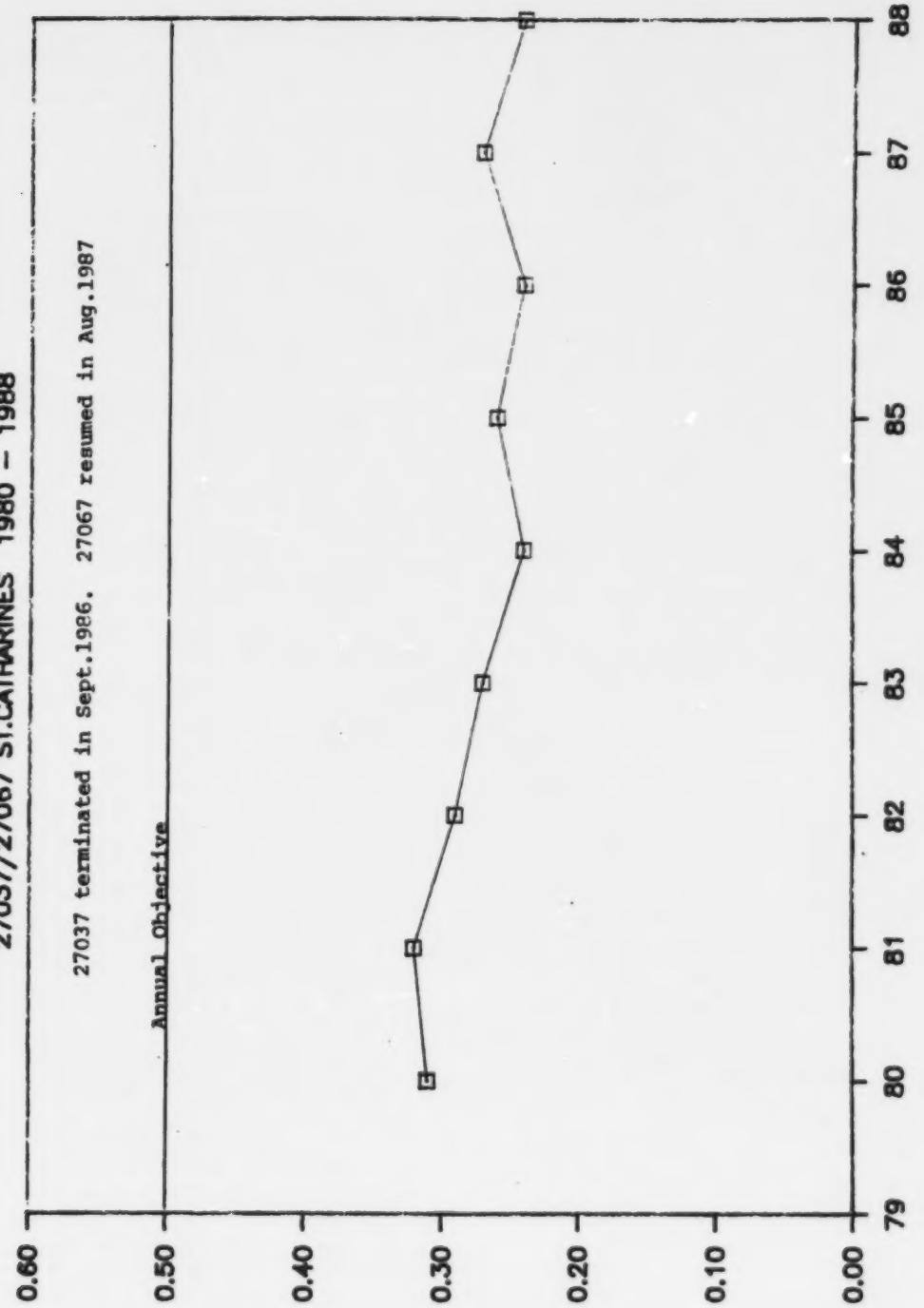


FIGURE 25

CARBON MONOXIDE YEARLY TREND

27037/27067 ST.CATHARINES 1977 – 1988

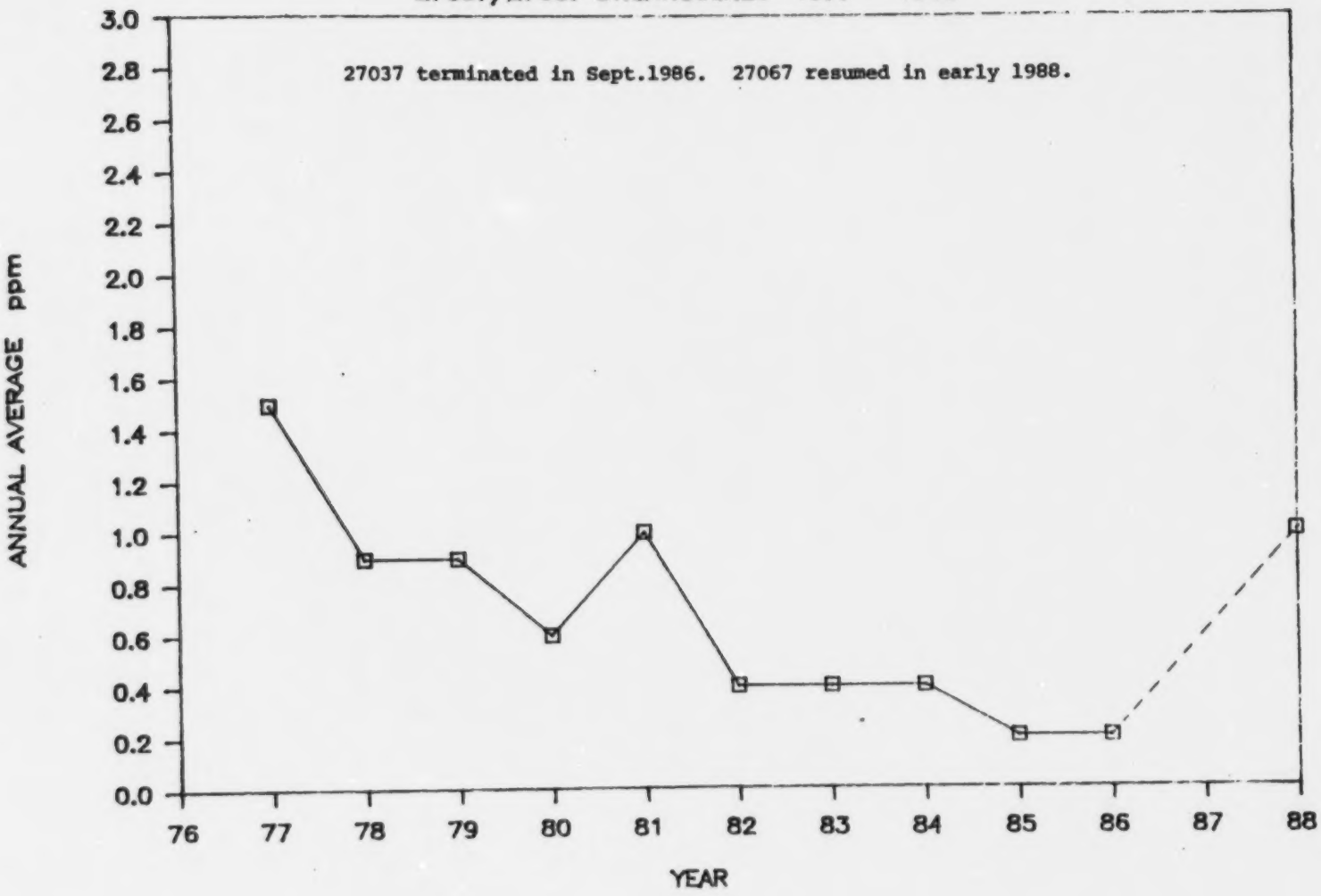


FIGURE 26

NITROGEN DIOXIDE YEARLY TREND

27037/27067 ST.CATHARINES 1977 – 1988

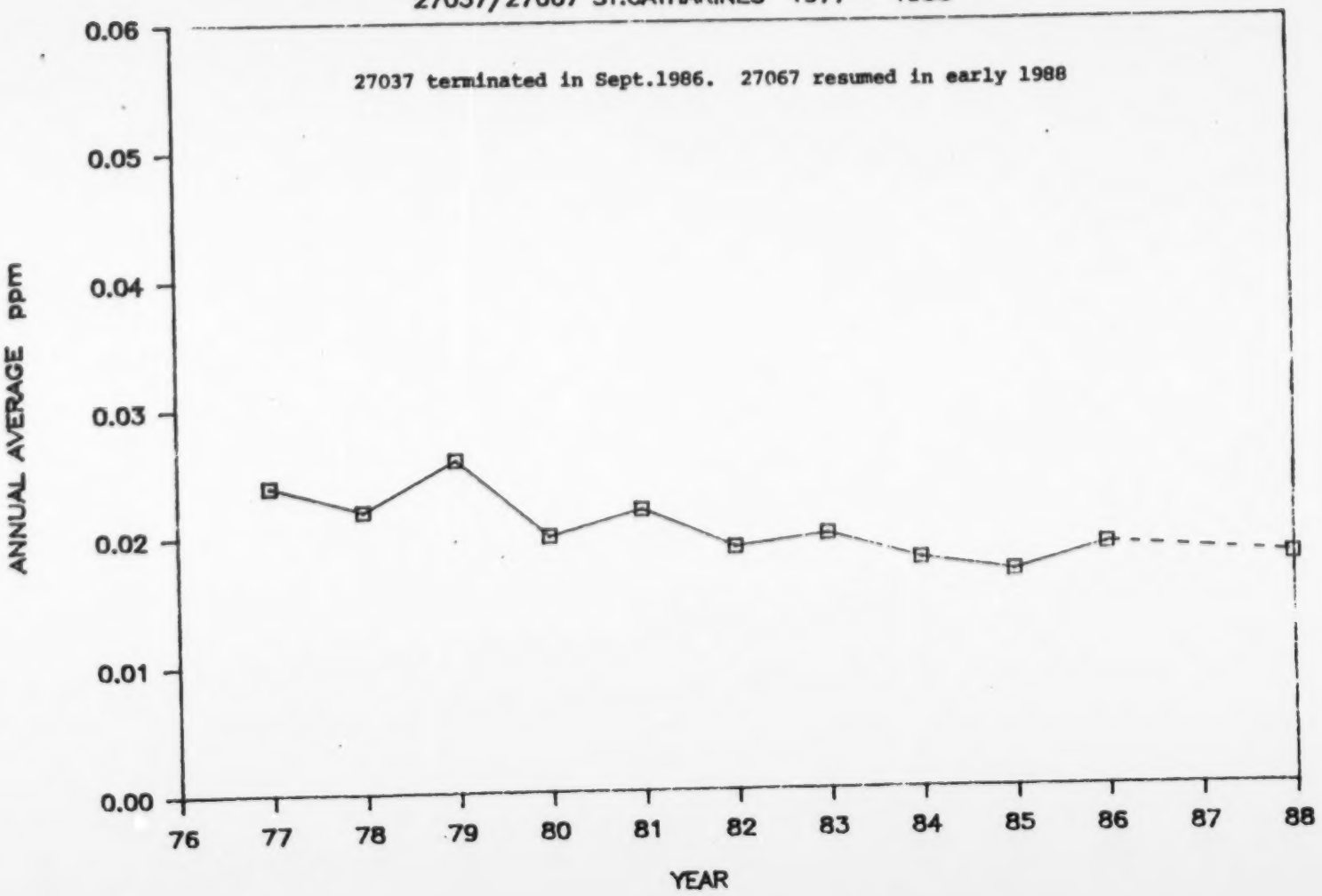
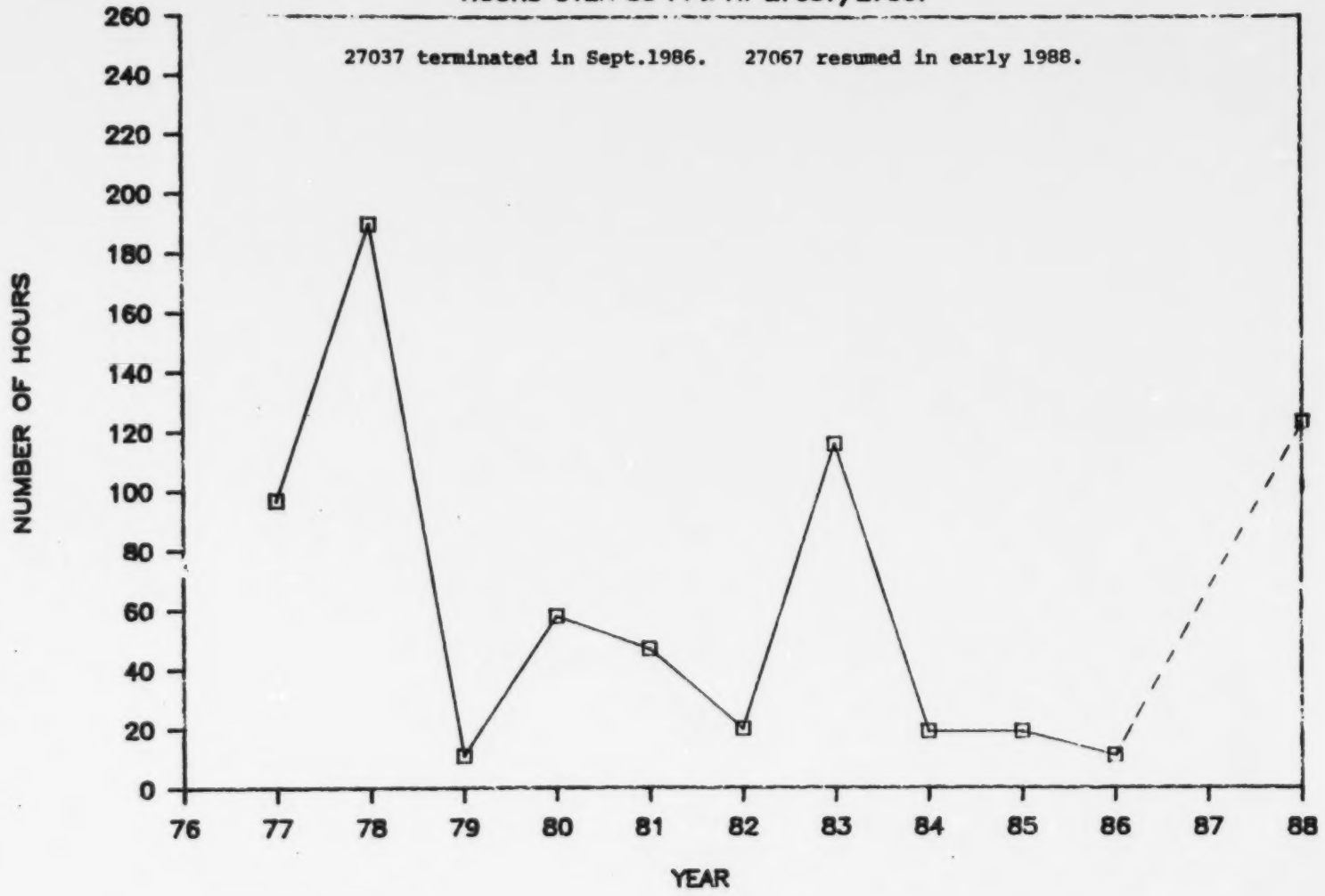


FIGURE 27

OZONE EXCEEDENCE TREND – ST.CATHARINES

HOURS OVER 80 PPB AT 27037/27067



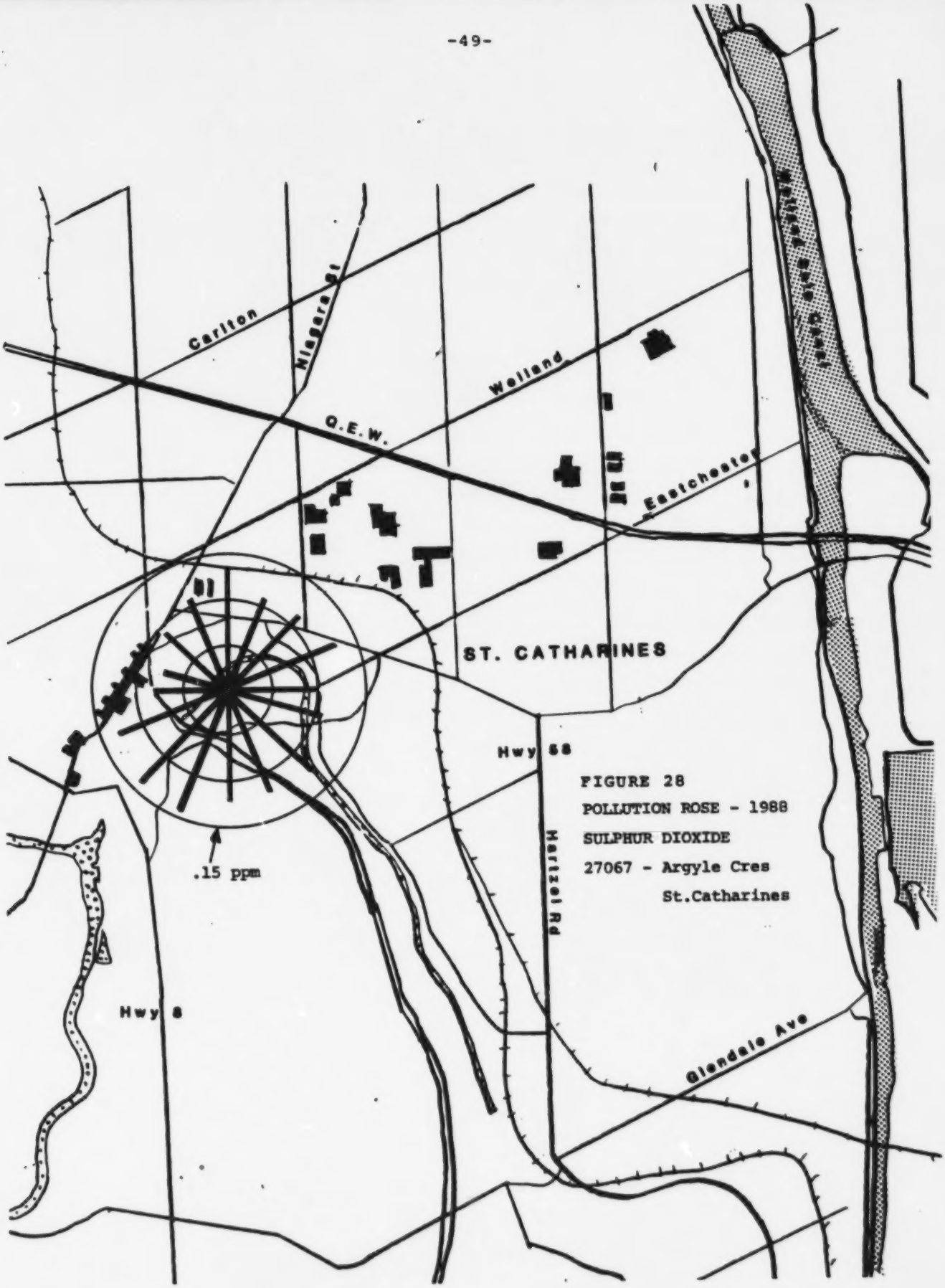


FIGURE 28
POLLUTION ROSE - 1988
SULPHUR DIOXIDE
27067 - Argyle Cres
St.Catharines

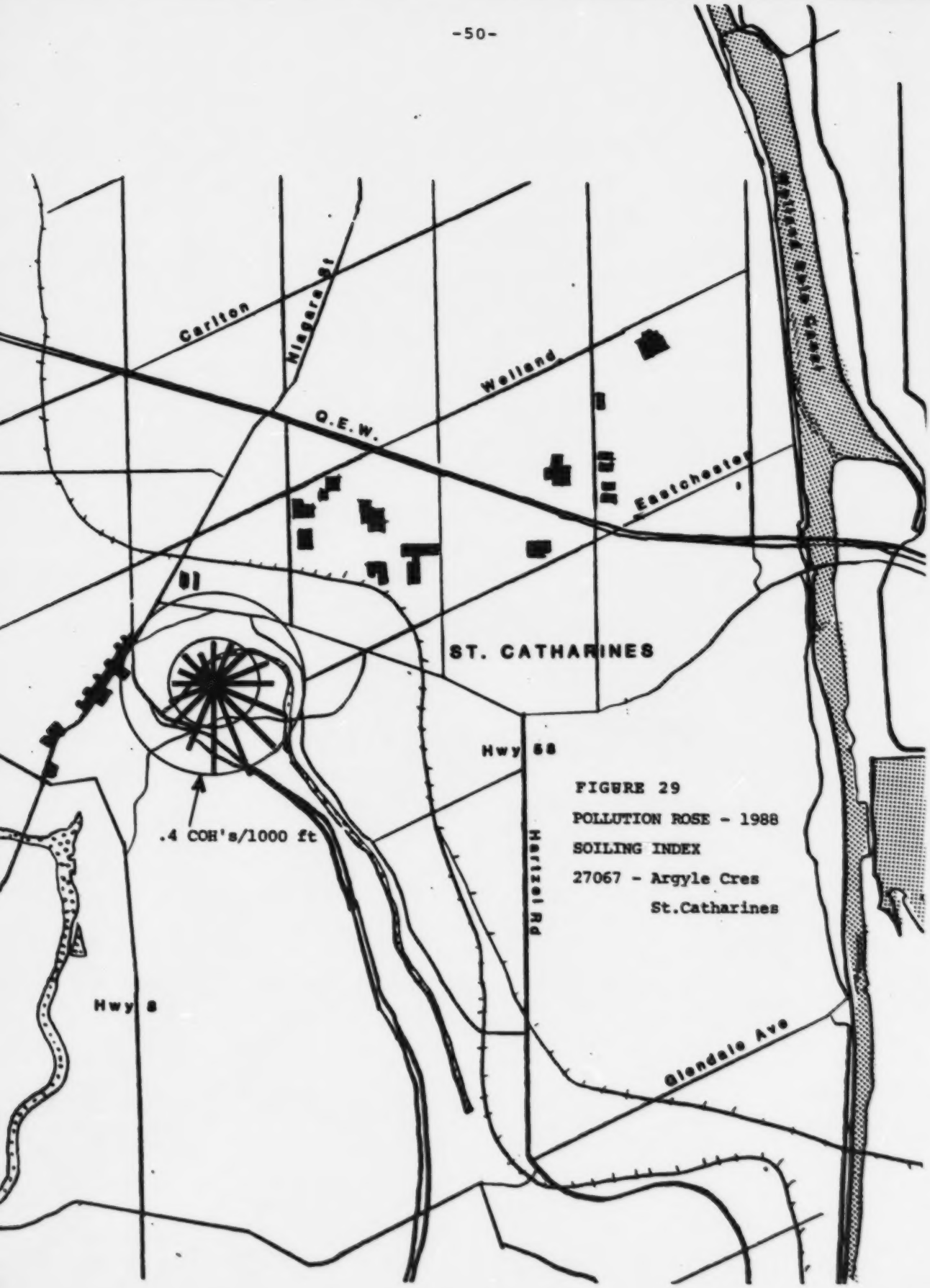


FIGURE 29
POLLUTION ROSE - 1988
SOILING INDEX
27067 - Argyle Cres
St.Catharines

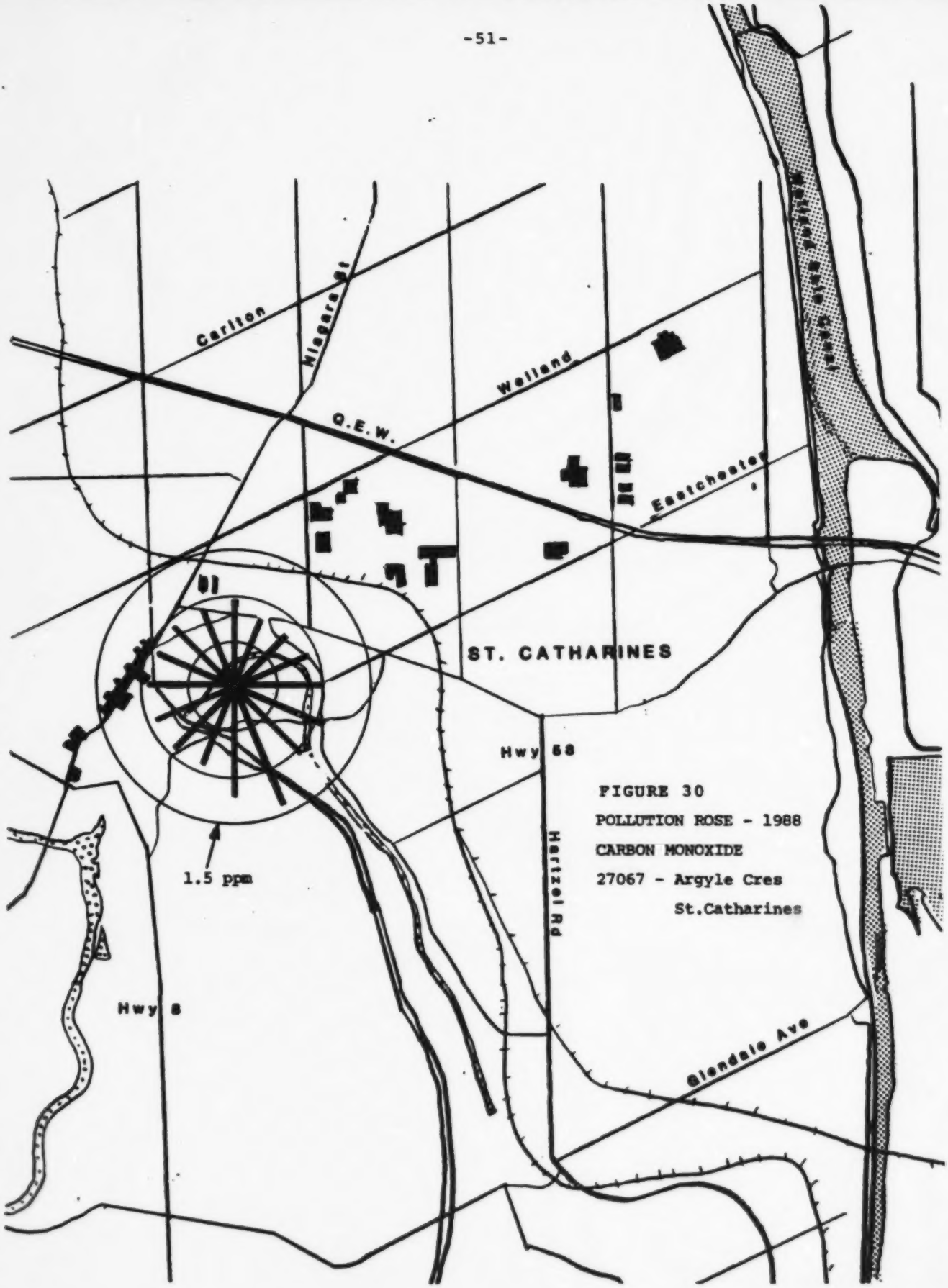


FIGURE 30
POLLUTION ROSE - 1988
CARBON MONOXIDE
27067 - Argyle Cres
St.Catharines

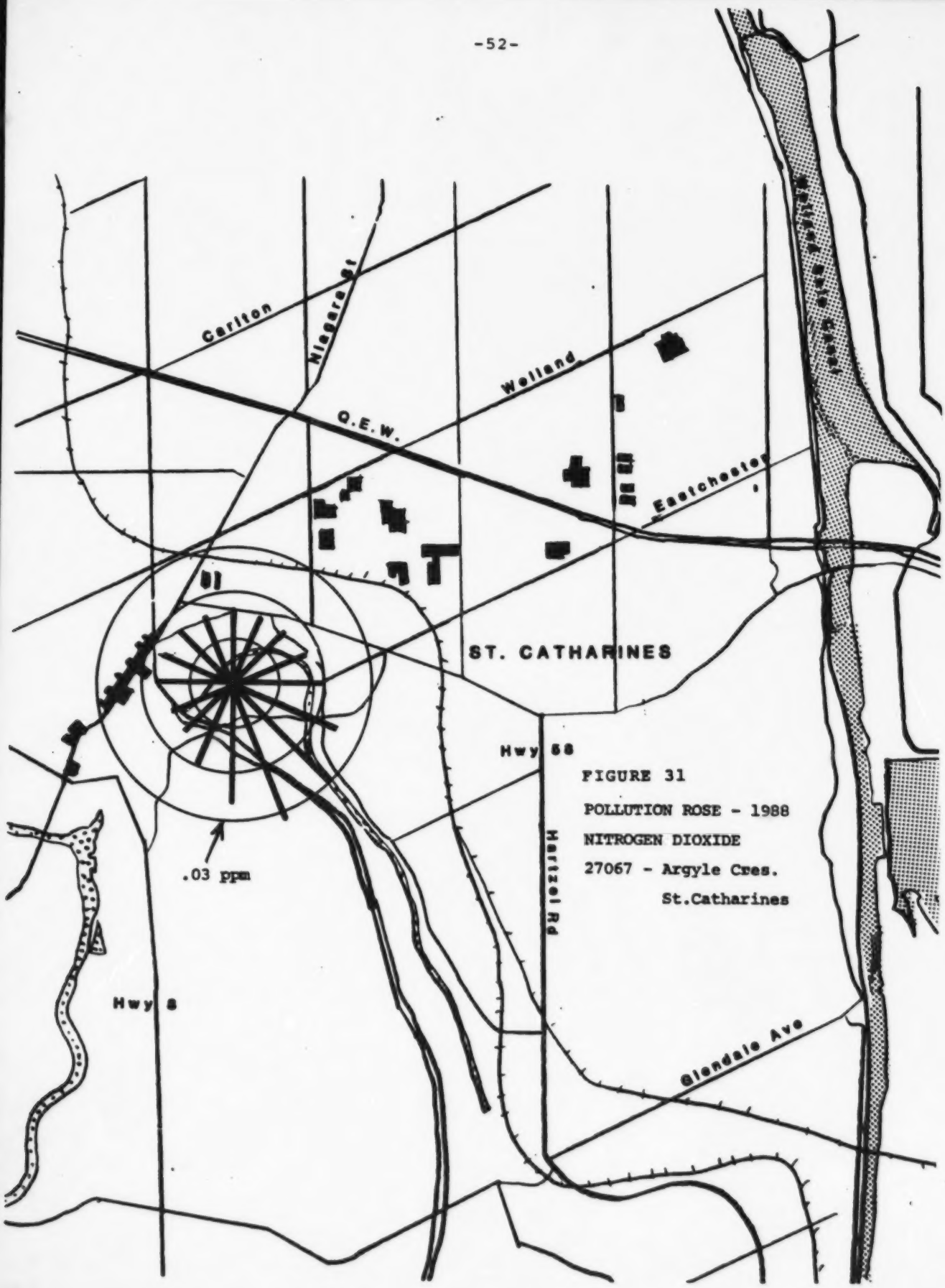


FIGURE 31

POLLUTION ROSE - 1988

NITROGEN DIOXIDE

27067 - Argyle Cres.

St.Catharines

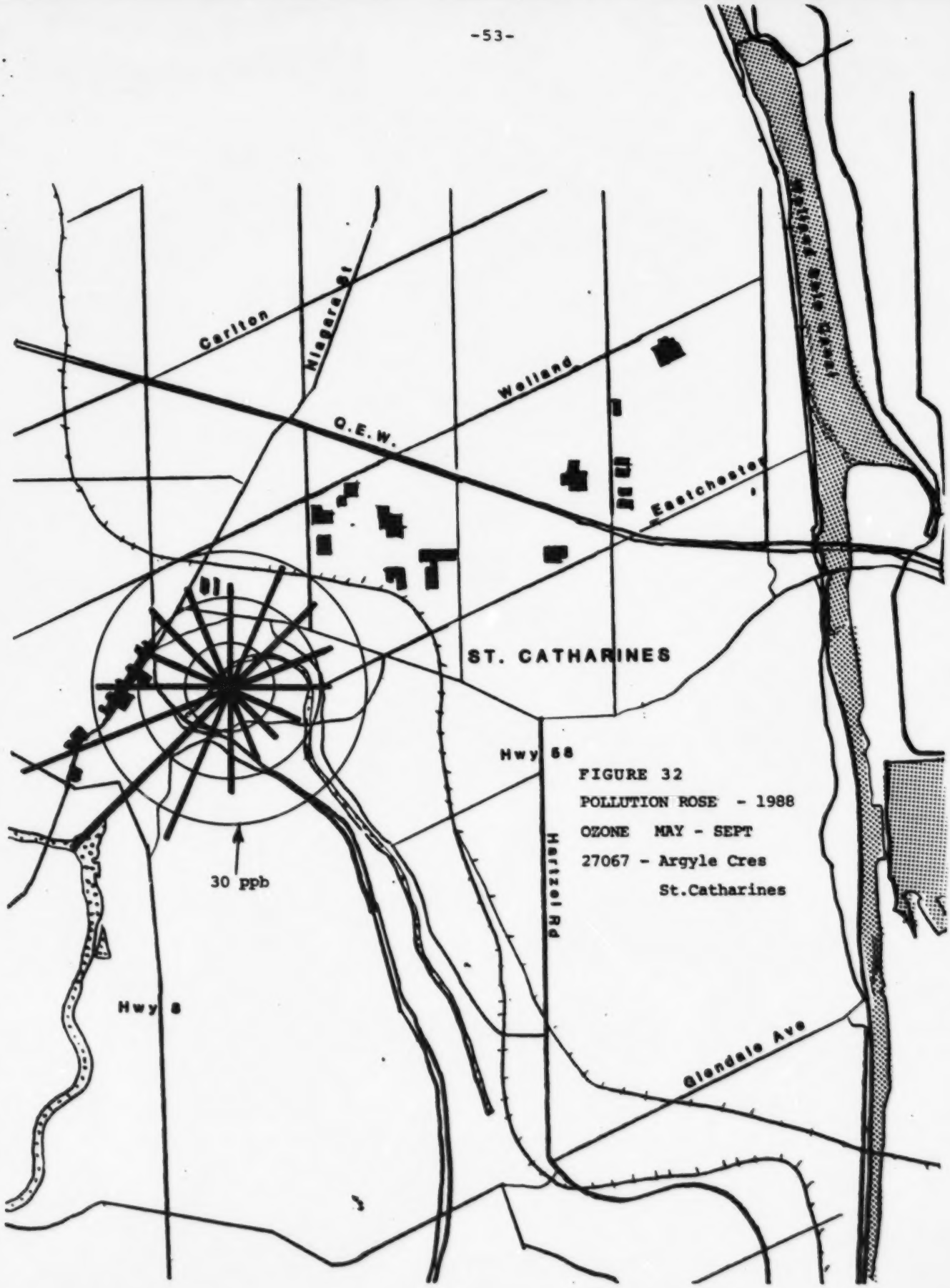


FIGURE 32
POLLUTION ROSE - 1988
OZONE MAY - SEPT
27067 - Argyle Cres
St.Catharines

FIGURE 33

SUSPENDED PARTICULATE YEARLY TREND

27037/27008 ST CATHARINES 1977 – 1988

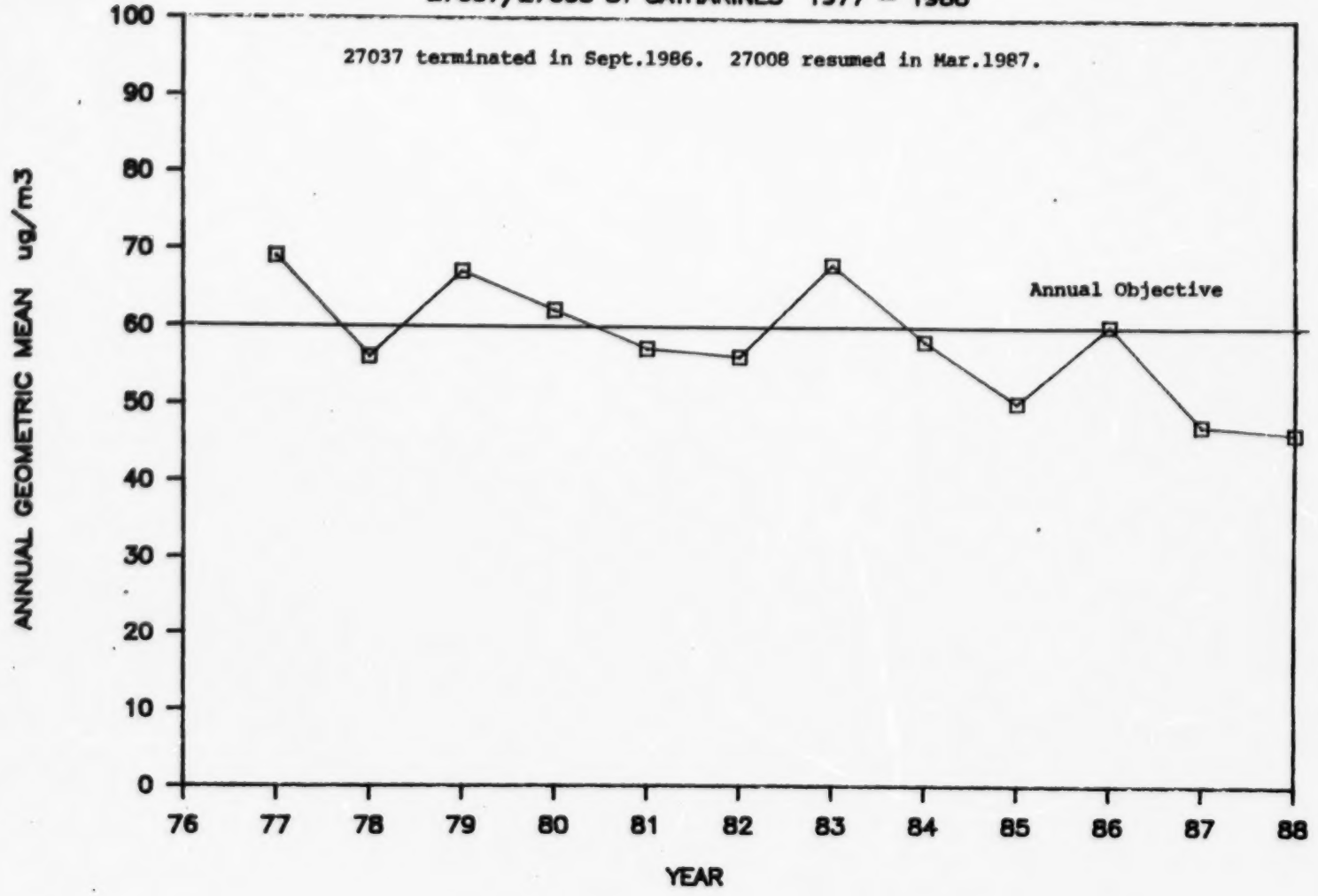


FIGURE 34

DUSTFALL YEARLY TREND – ST.CATHARINES

AIMCO/GM FOUNDRY/BURNSTEIN

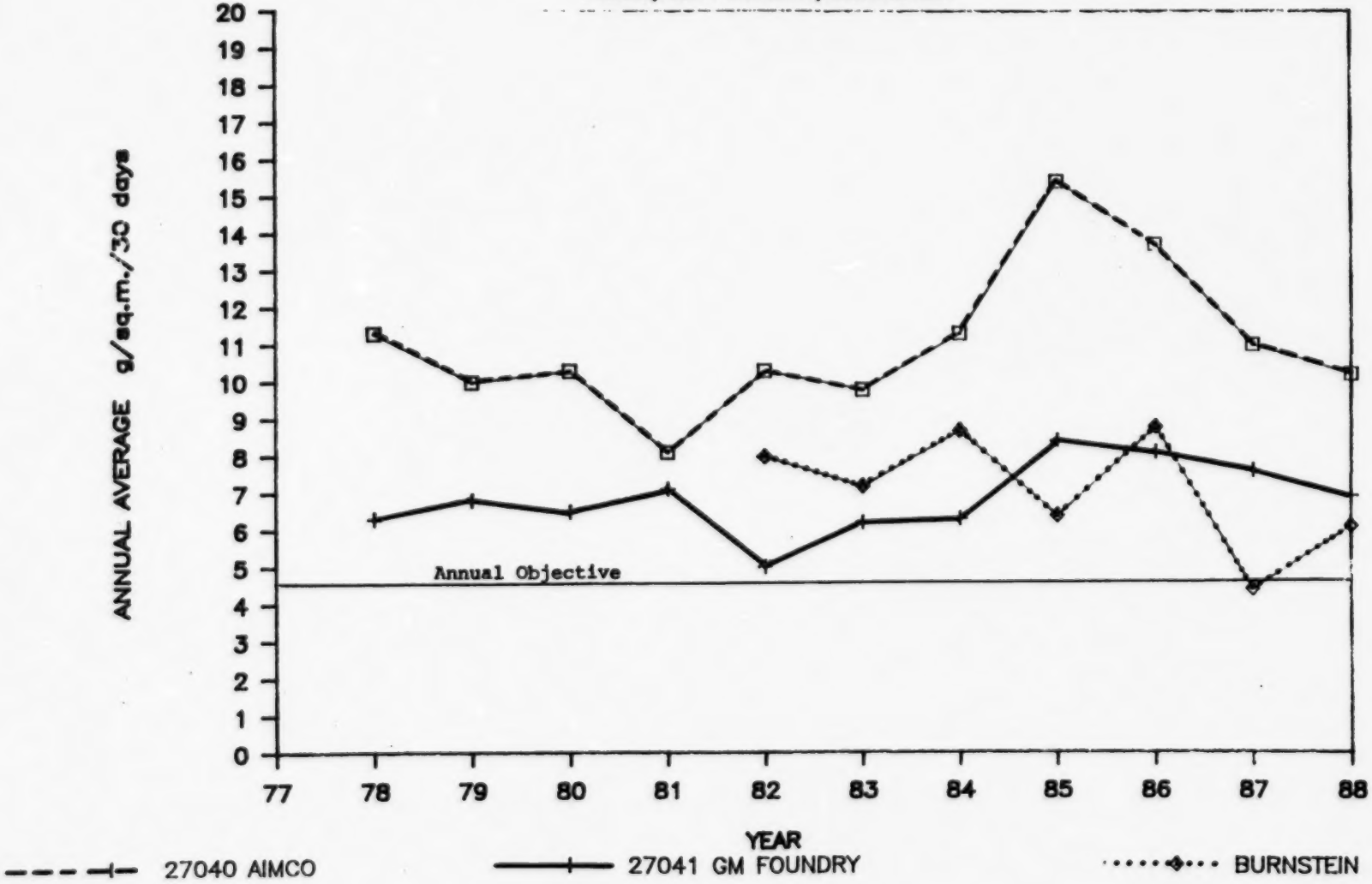


Figure 33 have been relatively stable over the years, fluctuating marginally above and below the annual objective although a gradual improvement seems evident in the graph.

Dustfall near the Aimco Foundry at the Plymouth Ave. station 27040 (Table 5) remained very high as shown in Figure 34, and continued to show elevated concentrations above objectives during 9 months. Concentrations have been essentially unchanged from the 1970's. The Ministry believes the dust emission problems are related to poor maintenance of dust control systems and general poor housekeeping. In 1989, the Ministry conducted an air emission survey with a mobile air monitoring van to study odorous emissions. The dust emissions will be surveyed in 1989 by the Ministry and the company will submit a voluntary control program in 1989. The emission survey is necessary because the dustfall readings could potentially be affected by other sources in the area.

Dustfall near the General Motors Foundry at Station 27041, Glendale and QEW, (Figure 22, Figure 34 and Table 5) was also high with 4 months exceeding the monthly objective including May-July. A nearby quarry and related trucking operations were potential contributors to the readings, and microscopic analyses of the samples did show that some samples were composed partly of non-foundry materials, namely carbonates. To ascertain the extent of the quarry's effect on 27041, a second jar (27063) was located directly on G.M. property, away from the quarry road. Data at this new location showed concentrations similar on average to 27041 and also yielded 5 exceedences of the monthly objective. Both stations showed an alternating effect from the quarry and from the foundry. Microscopic analysis showed some samples composed mostly of carbonate (quarry) while others were composed mostly of foundry materials such as carbon, silica and iron oxide. Levels at both stations were much lower from August to December, indicating fugitive dust sources may be the problem.

The major sources of foundry particulate emissions are the furnace operations. G.M. replaced one furnace control system in 1988 and the remaining furnace control system will be replaced in 1989.

Dustfall near Burnstein Castings at Station 27054, Catherine and Russel (Figure 22), showed three monthly loadings above the objective (Table 5). A gradual improvement from previous years is indicated in Figure 34. A survey of the company was carried out by Abatement staff and a number of problems were identified. A Control Order was served later in 1988 to address odour and particulate emission problems, however, the company appealed.

Thorold

Sulphur dioxide measured at Station 27042, Niagara Falls Rd. and Ontario St., across from Quebec and Ontario Paper Limited (Figure 35), showed an acceptable yearly average in 1988. There were no hourly readings above the hourly objective, and the daily objective was not exceeded (Table 6). The major source of SO_2 used to be the chemical recovery plant but this plant was shut down in 1988. The trend graph in Figure 36 displays the marked reduction in the number of exceedences of the hourly objective since 1983. Now that the chemical recovery plant has been shut down, and over a year's data of acceptable SO_2 levels were recorded, the SO_2 analyser was removed from service at the beginning of 1989.

Dustfall near the paper mill is given in Table 6. It shows that the yearly average at station 27042 was only moderately higher than the background station 27043 at McAdam Park. Four samples exceeded the monthly objective at 27042. The trend graph in Figure 37 shows that improvements have taken place during the 1980s. The source of particulate in 1988

TABLE 6

SUMMARY STATISTICS - THOROLD

SULPHUR DIOXIDE NEAR QUEBEC & ONTARIO PAPER LTD.

27042 - NIAG FALLS RD./ONTARIO ST.

POLLUTANT	ANNUAL AVERAGE 1986	1987	1988	1988 MAXIMUM 1 HR	24 HR	OBJECTIVE 1 HR	24 HR	1 YR	NO.TIMES OVER OBJECTIVE(1988) 1 HR	24 HR	1 YR
SULPHUR DIOXIDE SO2(ppm)	0.005	0.005	0.007	0.09	0.04	0.25	0.10	0.02	0	0	0

DUSTFALL - grams/square metre/30 days

ONT.OBJECTIVE : 7.0(1 MONTH)
4.5(ANNUAL AVERAGE)

STATION	ANNUAL AVERAGE 1986	1987	1988	1988 MAXIMUM 1 MONTH	NO.MONTHS OVER OBJECTIVE 1986	1987	1988
27042 - NIAG/ONT THOROLD	7.3	6.9	6.1	8.8	7	6	4
27043 - MCADAM PARK THOROLD	3.2	2.4	4.1	9.5	0	0	1

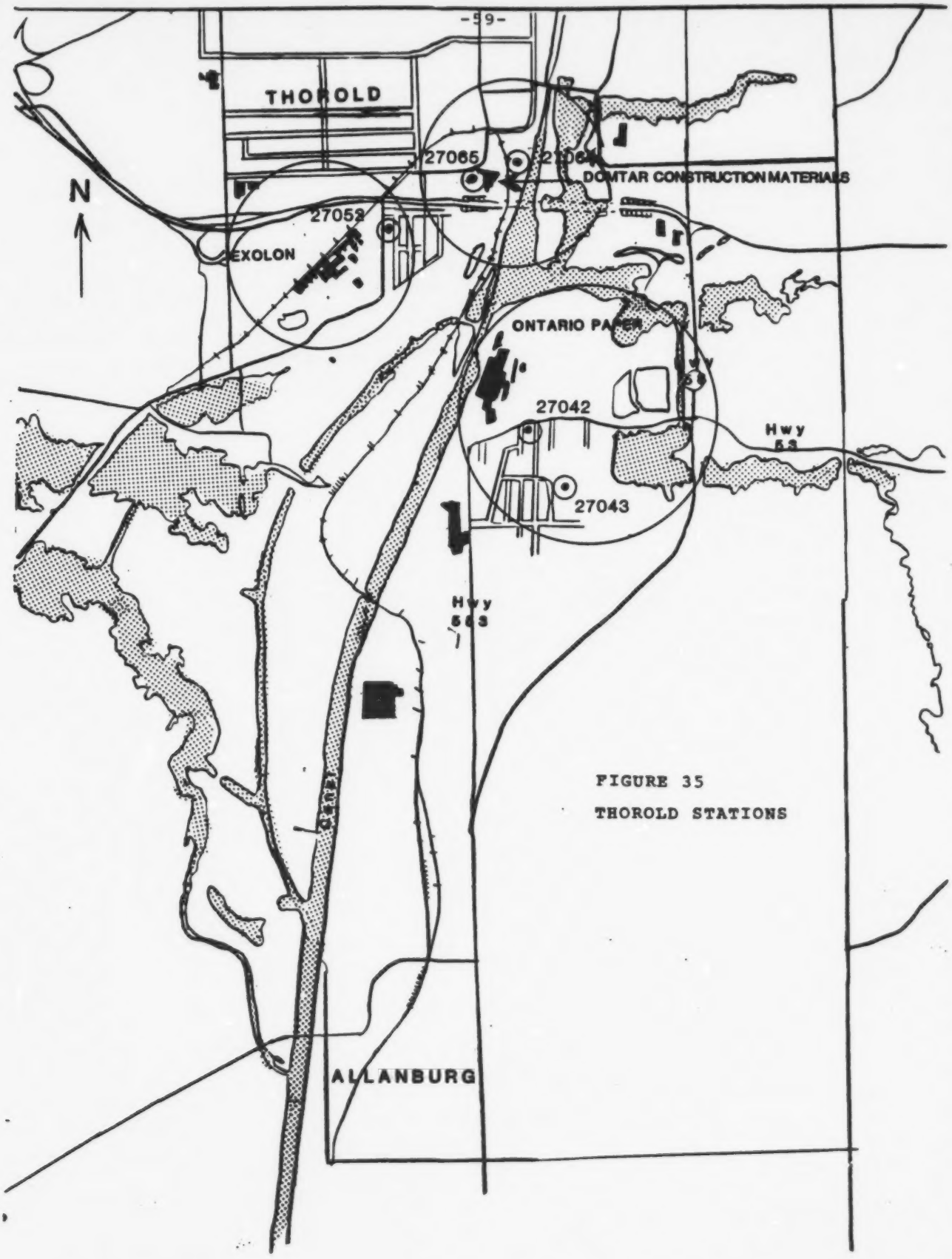


FIGURE 35
THOROLD STATIONS

FIGURE 36

SO2 EXCEEDENCE TREND – THOROLD

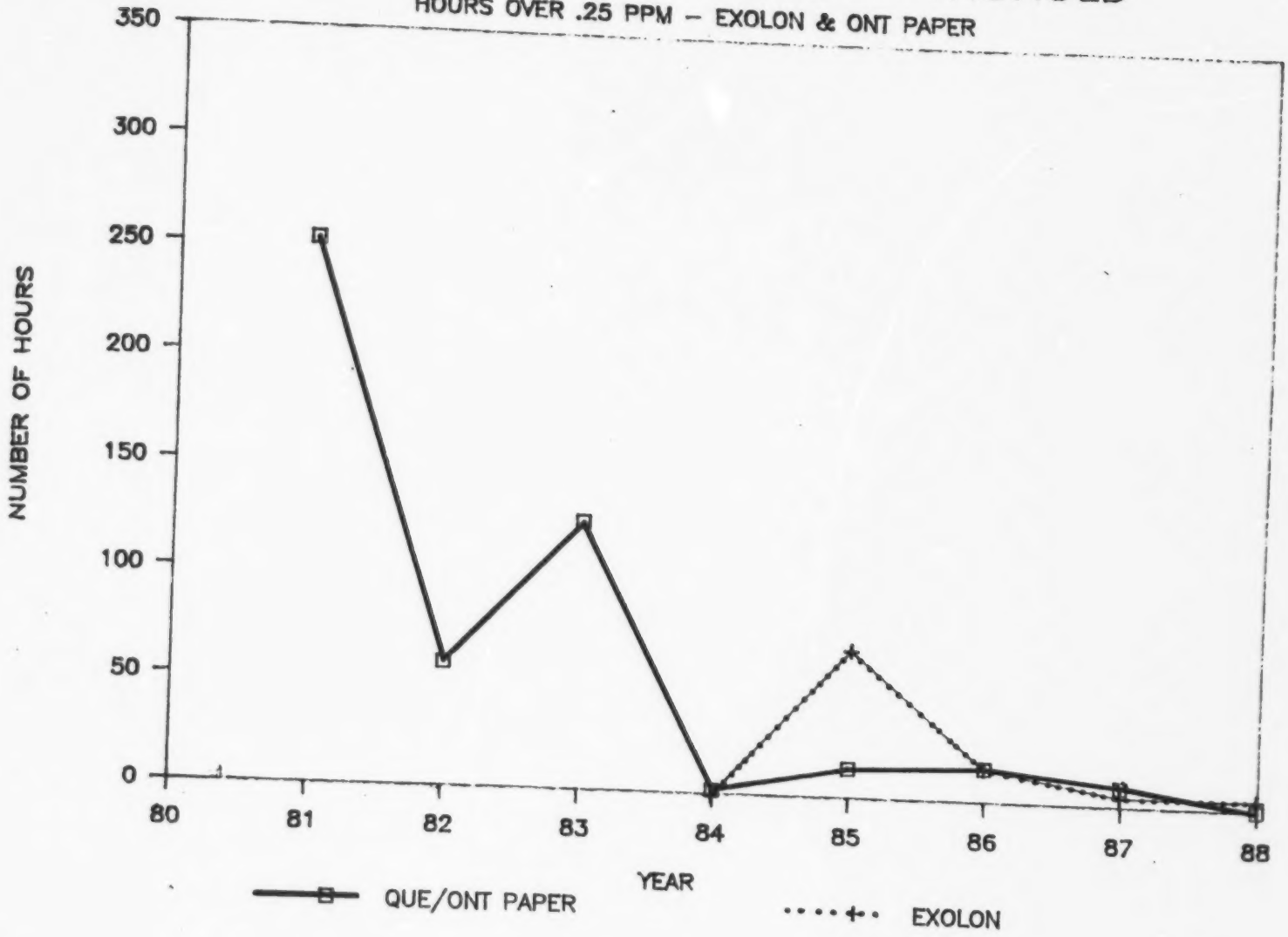
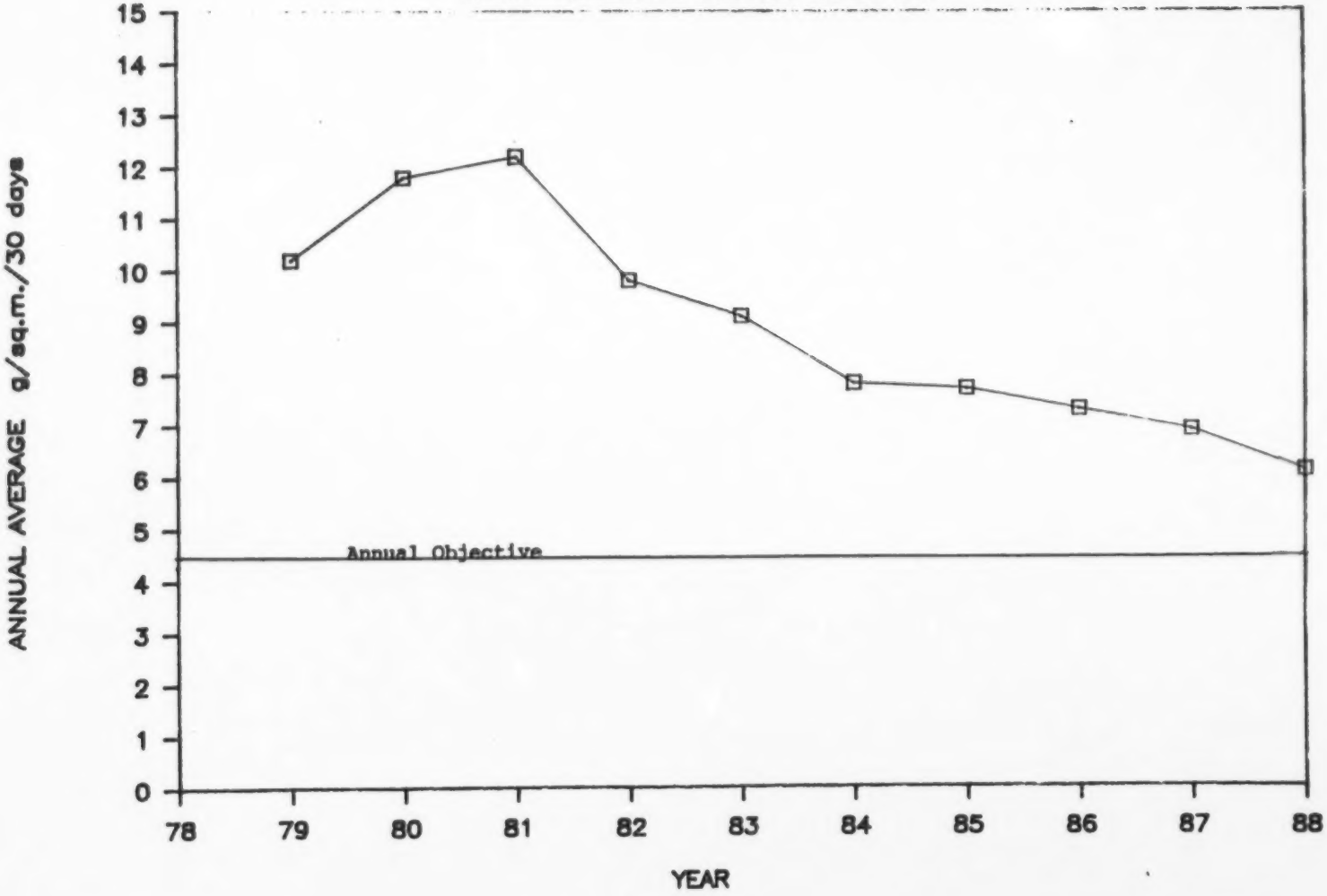


FIGURE 37

DUSTFALL YEARLY TREND – THOROLD

27042 QUEBEC & ONTARIO PAPER CO.



was likely fugitive in nature due to demolition of the chemical recovery plant, truck traffic and nearby construction.

Station 27052 lies 100 metres northeast of Exolon Ltd. on Queen Street (Figure 35) and consists of a hi-vol, soiling index tape sampler and SO_2 and TRS analyzers. Data are summarized in Table 7. Sulphur dioxide levels increased from 1987 on average, but recorded only 5 exceedences of the hourly objective (similar to 1987). TRS levels which were already extremely high, increased in 1988 to comparable levels found in 1984. There were 684 hours above the hourly objective for hydrogen sulphide (20 ppb) and 1087 hours above 10 ppb - an approximate odour threshold for H_2S. There were 583 such hours in 1987. The deterioration is illustrated in Figure 38 and is thus far unexplained.

The major sources of these emissions are the silicon carbide furnaces. The company instituted but did not complete a voluntary program in 1986 to modernize furnace operations. The Ministry is conducting an emission survey in 1989, with the intent of serving a Control Order.

The pollution roses in Figures 39 and 40 indicate the influence of Exolon as both SO_2 and TRS peaked sharply under west winds.

Suspended particulates at station 27052 (Table 7) showed extremely high levels with a geometric mean of 114 ug/m³ (although this was down from 167 in 1987), and 20 out of 44 samples exceeded the daily objective. Power supply problems caused the loss of about 2 months of data during the critical June/July drought period. This may at least partly account for the TSP reduction. The silicon carbide furnaces at Exolon are the major source of particulate emissions.

TABLE 7

SUMMARY STATISTICS - THOROLD

CONTINUOUS POLLUTANTS NEAR EXOLON LTD.

27052 - QUEEN ST.

POLLUTANT	ANNUAL AVERAGE 1986	1987	1988	1988 MAXIMUM 1 HR	24 HR	OBJECTIVE 1 HR	24 HR	1 YR	NO.TIMES OVER OBJECTIVE(1988) 1 HR	24 HR	1 YR
SULPHUR DIOXIDE SO2(ppm)	0.012	0.008	0.021	0.29	0.13	0.25	0.10	0.02	5	3	1
SOILING INDEX COH(COH'S)	0.30	0.31	0.37		1.0		1.0	0.5		0	0
TOTAL REDUCED SULPHUR (TRS) (ppb)	1.9	3.0	6.4	169		20(H2S)			684 1087 hours › 10ppb		

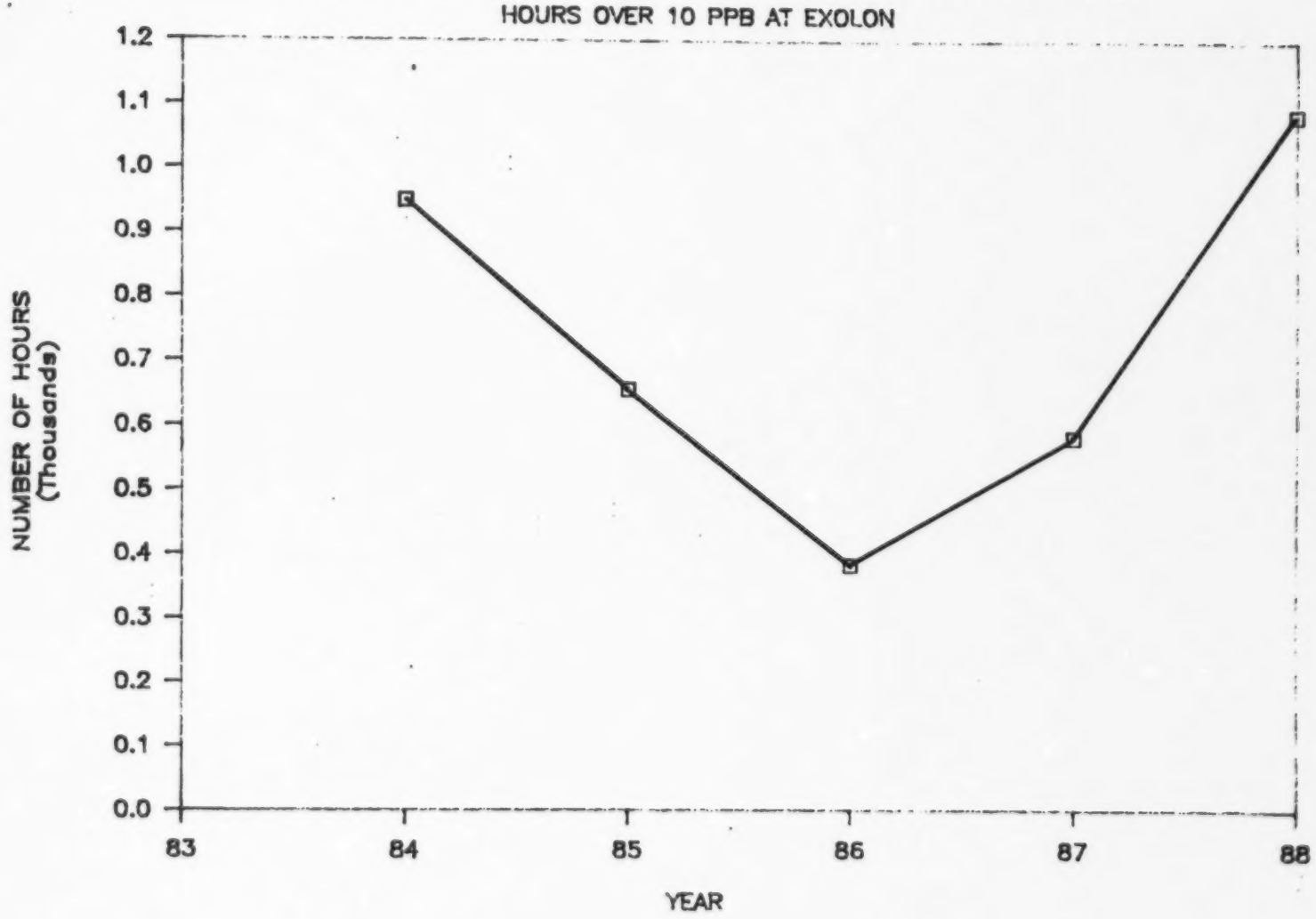
ONT.OBJECTIVES: 120 (24 hour)
60 (annual geo.mean

SUSPENDED PARTICULATES - micrograms per cubic metre

STATION	GEOMETRIC MEAN 1986	1987	1988	1988 MAXIMUM 24 HR	NO.OF SAMPLES	NO.TIMES OVER OBJECTIVE(1988) 24 HR	1 YR
27052 QUEEN ST	144	167	114	544	44	20	1

FIGURE 38

TRS EXCEEDENCE TREND -- THOROLD



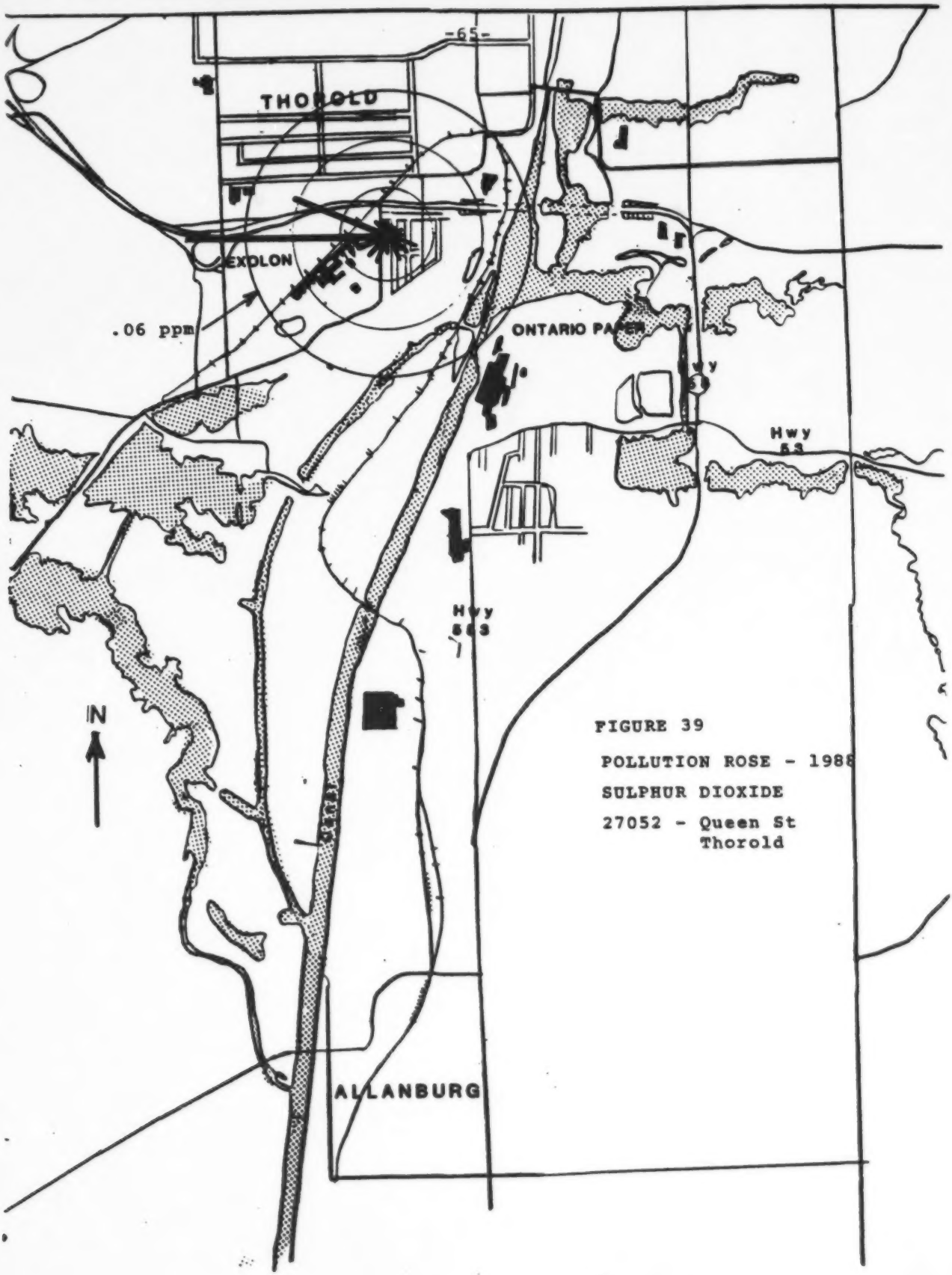


FIGURE 39

POLLUTION ROSE - 1988

SULPHUR DIOXIDE

27052 - Queen St
Thorold

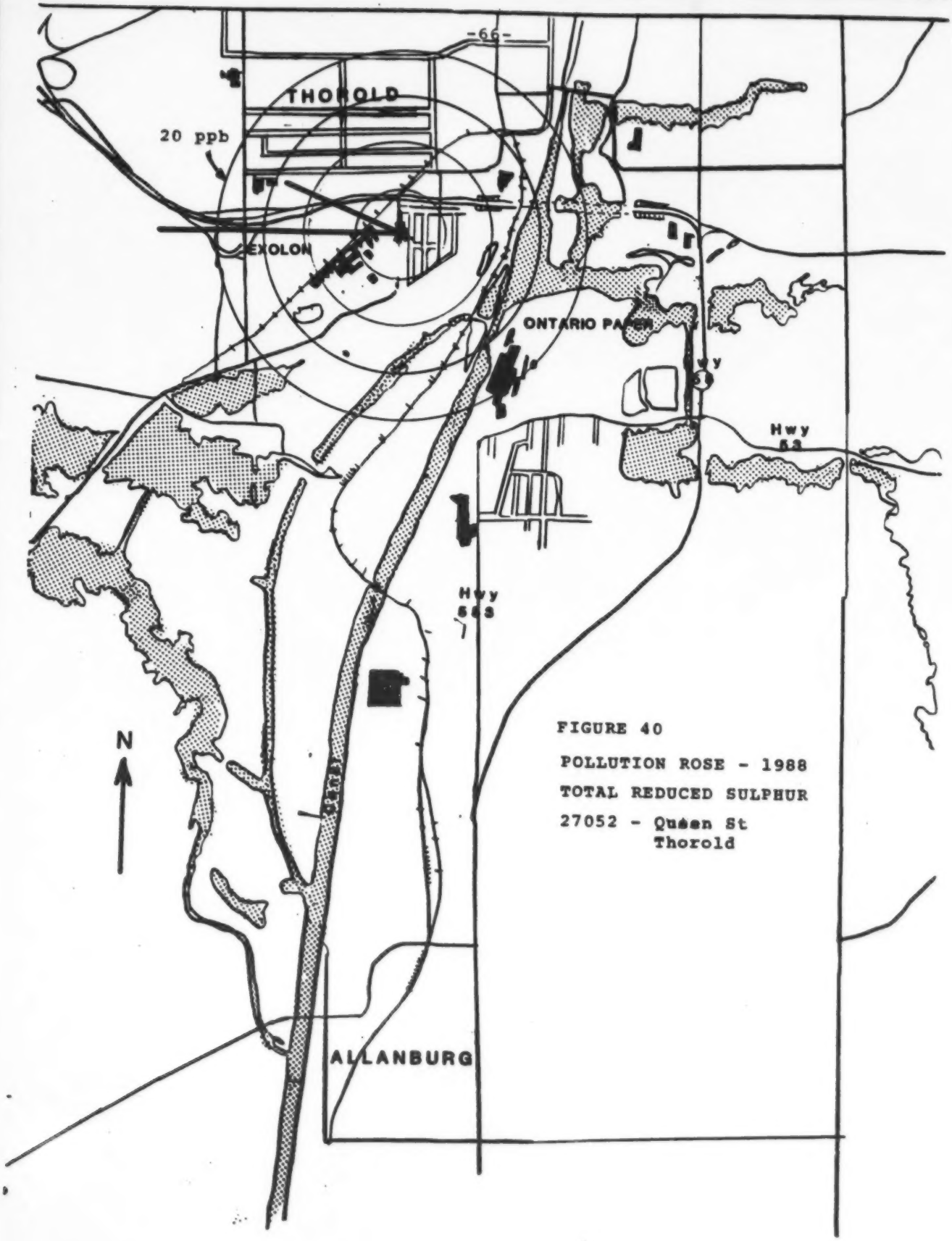


FIGURE 40

POLLUTION ROSE - 1988

TOTAL REDUCED SULPHUR

27052 - Queen St
Thorold

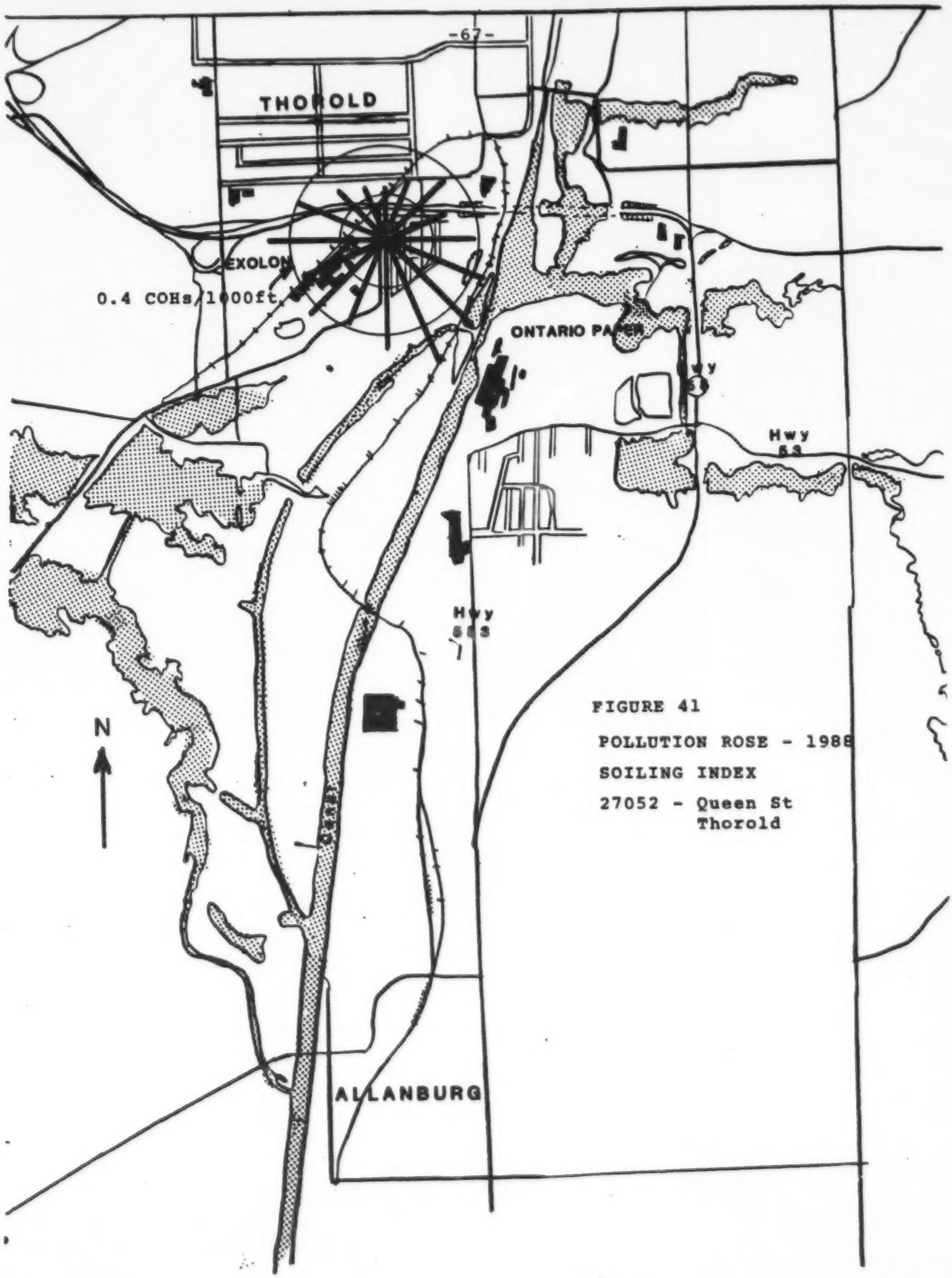


FIGURE 41

POLLUTION ROSE - 1988

SOILING INDEX

27052 - Queen St
Thorold

TABLE 8

SUMMARY STATISTICS - THOROLD

PARTICULATES NEAR DOMTAR FINE PAPERS LTD.

DUSTFALL - grams/square metre/30 days

ONT.OBJECTIVES : 7.0(1 MONTH)
4.5(ANNUAL AVERAGE)

STATION	ANNUAL AVERAGE	1988 MAXIMUM	NO.MONTHS OVER OBJECTIVE
	1988	1 MONTH	1988
27064 - ORMOND/RICHMOND	6.4	10.0	5
27065 - WELLAND ST.	7.6	10.4	6

The soiling index tape sampler at 27052 recorded low levels of fine particulate with no exceedences of the daily objective (Table 7). The soiling index pollution rose in Figure 41 shows little impact from the plant. Particulate emissions from Exolon would seem to consist mostly of heavy material not measured by the tape sampler.

Beginning in late 1987, two dustfall jars were located near Domtar Construction Materials Ltd., a manufacturer of roofing material, following dust complaints (Figure 35). Data for 1988 is given in Table 8 and did indicate dustfall problems. The two stations, 27064 and 27065 measured 5 and 6 readings respectively above the monthly objective. The samples were analyzed microscopically and this found that the majority of the insoluble material collected contained wood fibres and various forms of carbon and iron oxide. The source of the wood fibre could be Domtar or a nearby lumber yard. Further monitoring will be required to better distinguish dust sources in the area.

Welland

Particulates near Union Carbide were measured by one high volume sampler and three dustfall jars (Figure 42).

Suspended particulate concentrations at station 27045, Alberta and Devon, (Table 9) were slightly higher in 1988. The yearly geometric mean was below the objective and the daily objective was exceeded 4 times, all during the June/July drought. The trend graph in Figure 43 shows a slightly declining trend since 1981, below the yearly objective.

Occasionally elevated carbon concentrations (Table 9) were measured, and these data correlated strongly with southwest wind frequency, indicating Union Carbide's localized

TABLE 9

SUMMARY STATISTICS - WELLAND

PARTICULATES NEAR UNION CARBIDE LTD.

SUSPENDED PARTICULATES - micrograms per cubic metre ONT.OBJECTIVES: 120 (24 hour)
60 (annual geo.mean)

STATION	GEOMETRIC MEAN 1986	1987	1988	1988 MAXIMUM 24 HR	NO.OF SAMPLES	NO.TIMES OVER OBJECTIVE(1988) 24 HR	1 YR
27045 ALBERTA/DEVON	42	48	55	171	51	4	0

ELEMENTAL CARBON IN SUSP.PARTIC. - micrograms per cubic metre

27045 ALBERTA/DEVON	3.1	3.0	4.0	15.9	51	No objective

TOTAL CARBON IN SUSP.PARTIC. - micrograms per cubic metre

27045 ALBERTA/DEVON	7.5	7.1	9.4	27.4	51	No objective

DUSTFALL - grams/square metre/30 days ONT.OBJECTIVES : 7.0(1 MONTH)
4.5(ANNUAL AVERAGE)

STATION	ANNUAL AVERAGE 1986	1987	1988	1988 MAXIMUM 1 MONTH	NO.MONTHS OVER OBJECTIVE 1986	1987	1988
27025 - HARRIET ST WELLAND	4.6	4.6	5.2	7.4	2	2	2
27026 - CHAFFEY ST WELLAND	4.4	3.7	3.3	4.5	2	0	0
27035 - ALBERTA ST WELLAND	9.9	7.6	8.3	16.4	9	5	6

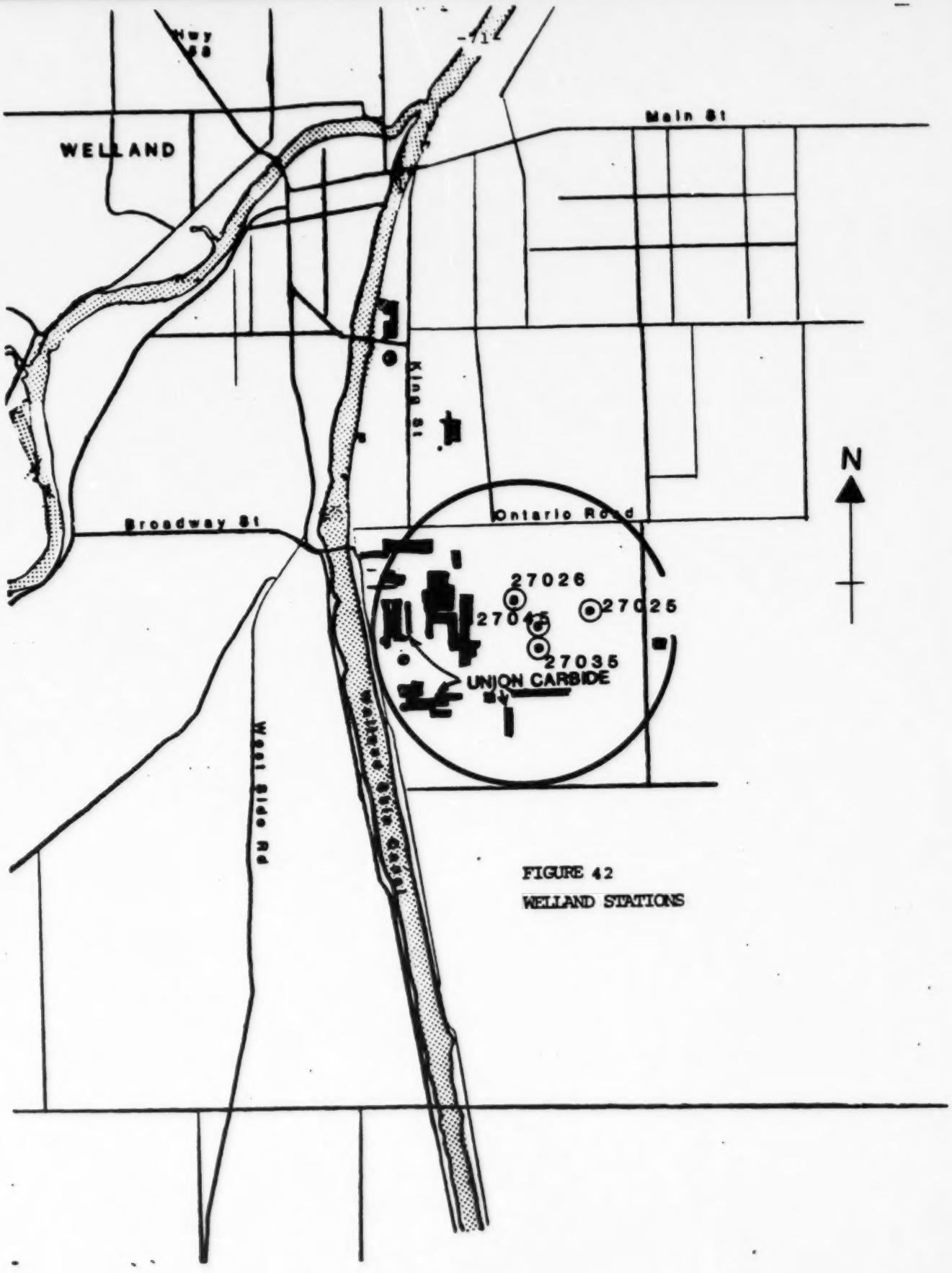


FIGURE 42
WELLAND STATIONS

FIGURE 43

SUSPENDED PARTICULATE YEARLY TREND

27045 UNION CARBIDE, WELLAND

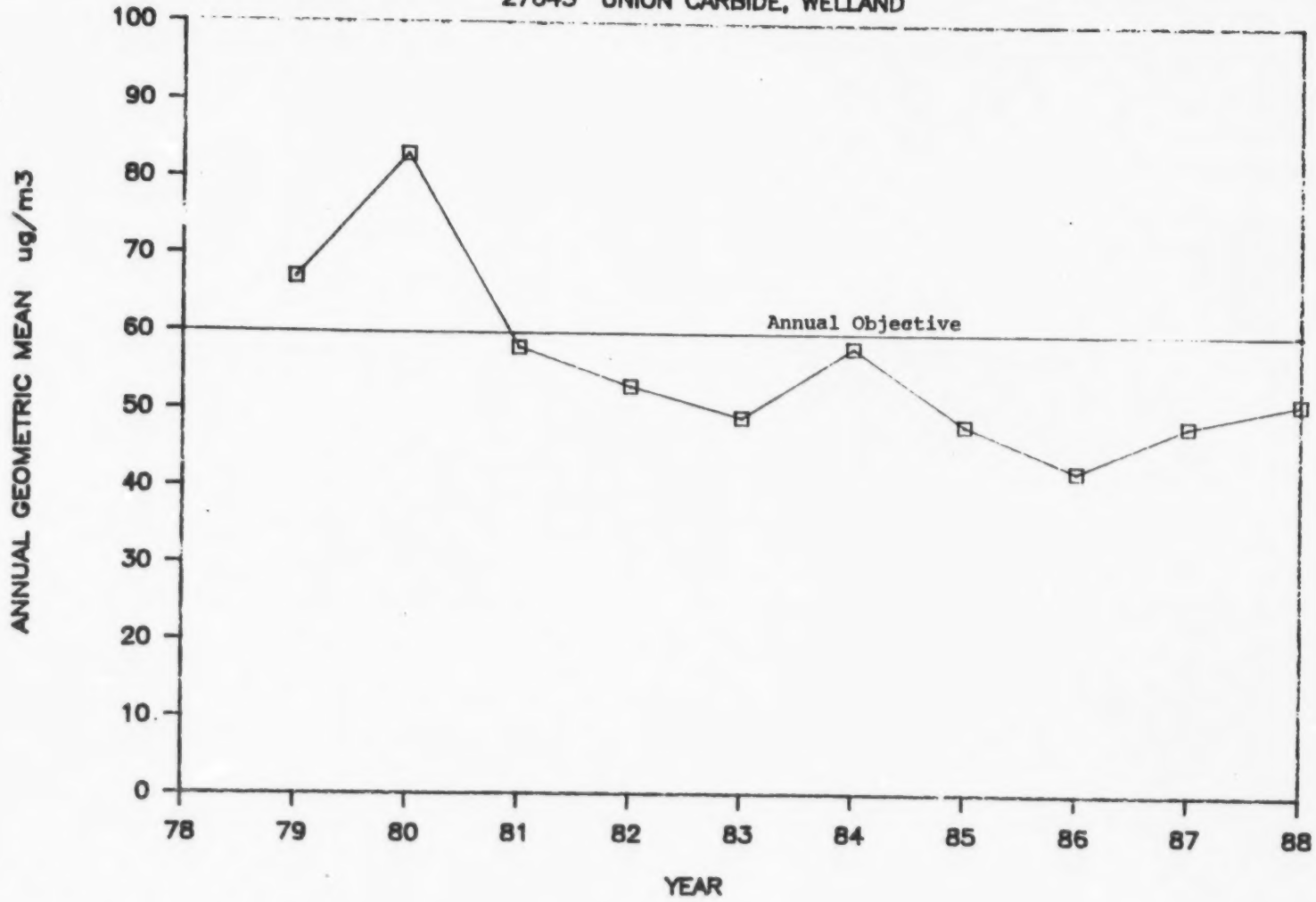
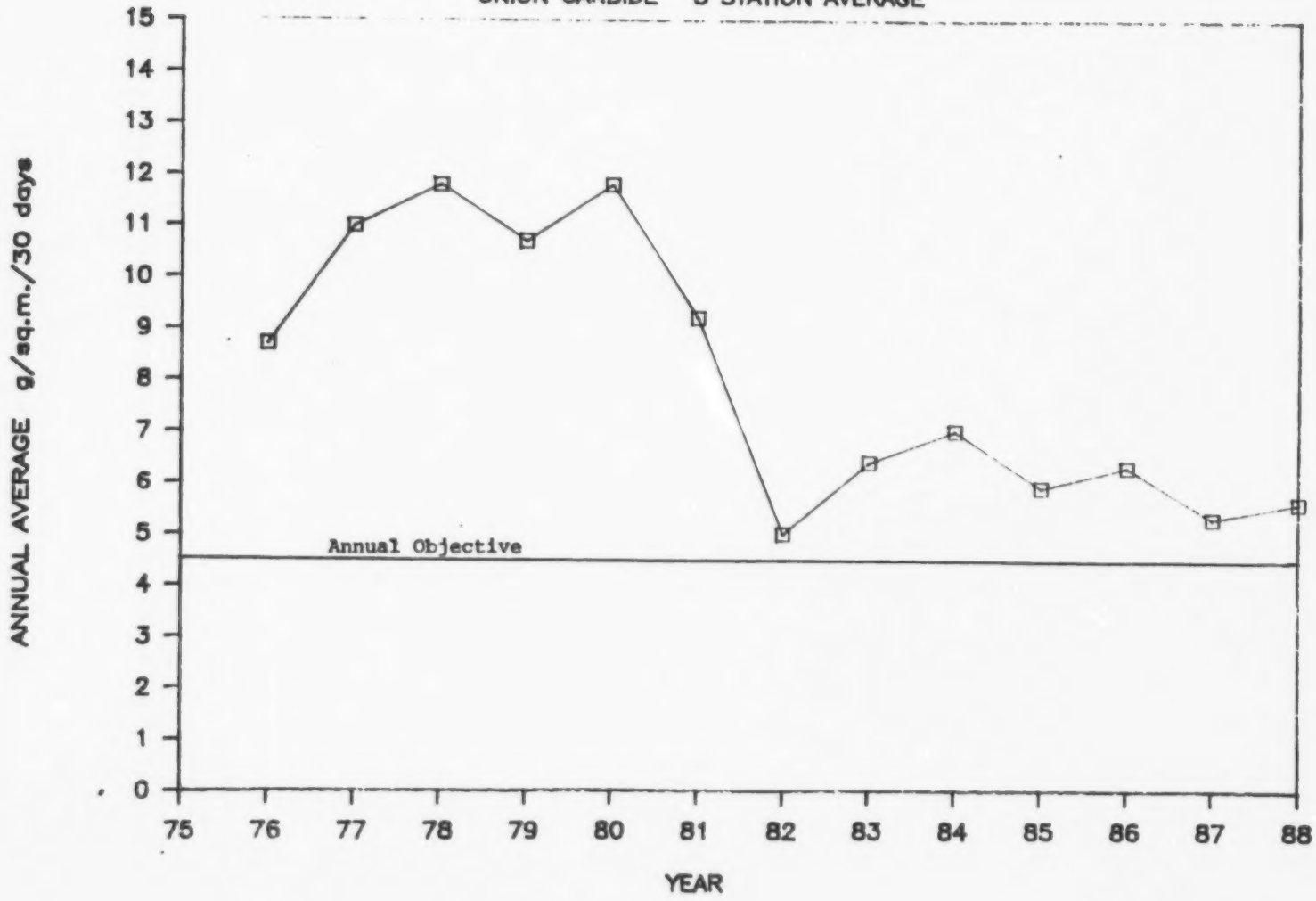


FIGURE 44

DUSTFALL YEARLY TREND – WELLAND

UNION CARBIDE 3 STATION AVERAGE



influence on the area. These carbon levels increased in 1988. One major source of dust emissions at Union Carbide is the carbottom furnaces.

Dustfall (Table 9) in the area has gradually declined over the years as shown by the trend graph in Figure 44. This decline is due mainly to various fugitive dust control efforts. One station, 27035 at the base of Alberta St. continued to show the highest levels, it being the closest to the carbottom furnaces. Six samples exceeded the monthly objective there compared to five in 1987. The other two monitors (27025-Harriet St. and 27026-Chaffey St.) recorded much lower levels with two exceedences of the monthly objective between them, both at 27025.

The Ministry's Investigations and Enforcement Branch have laid charges against the company in response to specific fallout incidents in 1987 and 1988.

Fugitive dust emissions from a landfill on company property are being addressed through seeding and dust suppression programs.

The Ministry's Abatement Section is conducting an emission survey of the plant in 1989, and will require the company to develop a control program.

SUMMARY

This report has identified several local air pollution concerns in the Regional Municipality of Niagara. All are currently under investigation with a view to implementing control programs. Some control programs are already underway.

Apart from these localized problems and with the exception of ozone episodes which were common to Southern Ontario, general air quality as characterized by the AQI (Air Quality Index) stations in Niagara Falls and St. Catharines was very good.

In 1988, a new air quality data telemetry system was installed and is operational throughout the Province. This new system permits all of the Ministry's stations with continuous analyzers to send data directly to a central computer facility in Toronto, allowing for data retrieval on a real-time basis. In the past, only the Niagara Falls and St. Catharines stations and the meteorological tower near Allanburg had this capability. Data from the remainder of the stations required manual reading of strip charts which caused delays of several months in the availability of data. The new system allows for immediate access to data, both in the Regional Office in Hamilton and in Toronto, and also allows for remote control and maintenance of the instruments. All of this results in a more efficient monitoring program.

The main purpose of the new telemetry system was to facilitate a new and expanded Air Quality Index (AQI). The new AQI is a function of six different pollutants, which will form up to eight separate subindices. Concentrations of sulphur dioxide, soiling index, carbon monoxide, nitrogen dioxide, total reduced sulphur and ozone are all individually converted to the old scale of index numbers with the same advisory or alert levels of 32, 50, 75 and 100. Not all

stations will measure all of the parameters, but the highest subindex and the pollutant causing it will be reported several times daily to the public. In the Niagara Region, the new AQI is being reported for the St. Catharines (27067) and Niagara Falls (27056) stations. The intent of the new index is to better inform the people of Ontario of air quality in their local area.